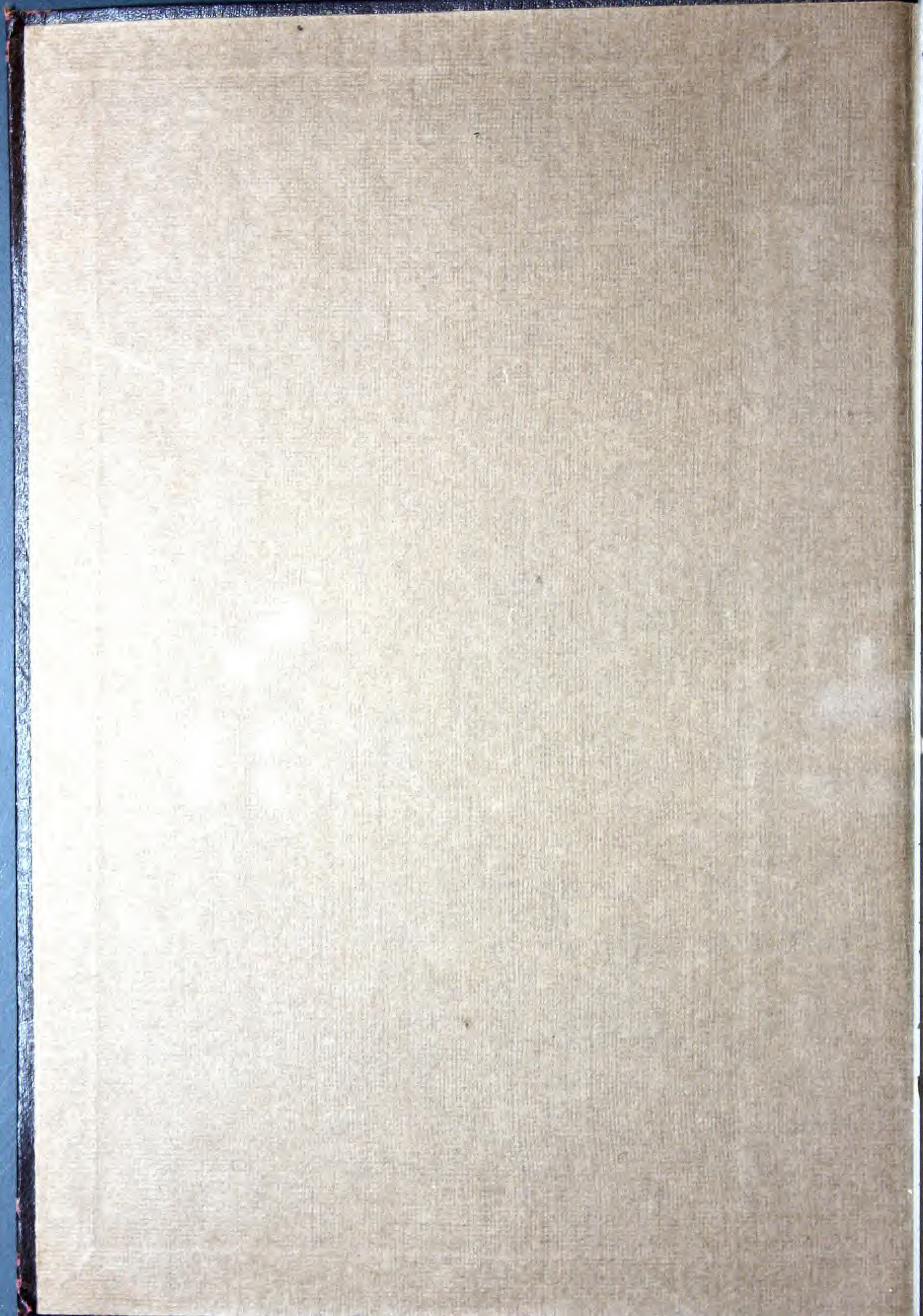


Referendex *1914-15*

Referendex Company Limited.
TORONTO CANADA





Referendex

:: A MANUAL OF ::
ARCHITECTURAL SPECIFICATIONS
AND CONSTRUCTION INFORMATION

CATALOGUE ANNOUNCEMENTS OF
MANUFACTURERS AND DEALERS IN
:: BUILDING SUPPLIES ::

INDEXED BY CONCERNS,
MATERIALS AND TEXT

1914-15
EDITION

DEvised, COMPILED AND EDITED BY
REFERENDEX COMPANY LIMITED

121 SIMCOE STREET
TORONTO : CANADA

Entered according to Act of the Parliament of Canada,
in the year One Thousand Nine Hundred and
Fourteen by Referendex Company
Limited, at the Department
of Agriculture

FOREWORD

THE aim of the projectors of *Referendex* was as ambitious as original. In short their aim was to produce a work that should become indispensable to Architect, Contractor, and Engineer alike. A technical library and catalogue in itself. One handy volume of all the essential data that previously had been scattered among a host of separate treatises, catalogues and booklets.

The publishers have spared no effort, nor disregarded any counsel in order to make the 1914-15 edition worthy of a continuance of the approbation so freely bestowed upon their initial effort.

Referendex Indexed Catalogue of Building Construction fills a long felt want. In late years the Architect has been the victim of, one might term, the "catalogue mania". Every firm in the building material field was issuing catalogues of every size and description from the small booklet to the large portfolio. Hundreds of these were precipitated yearly on the Architect who naturally came to regard them as a pest and relegated them to the waste paper basket.

We are endeavoring to make every page of advertising matter in this publication a condense of the advertisers' catalogues so that the Architect and Contractor may refer to it at a moment's notice without wading through multitudes of booklets and catalogues.

The ultimate test of an advertisement is that it shall be believed. Many manufacturers get the idea that the more hot air they put into an advertisement the more likelihood of results. It has been a difficult matter to convince the manufacturer of the futility of display advertising features in their advertisements in a technical publication. They are dissatisfied because *Referendex* does not allow them even more display than is the case. Time is necessary to eradicate these persuasions. But eradicated they will be.

In compiling the technical information, specification and editorial matter special care has been exercised to make the data accurate and reliable. Many men in the technical field have assisted us by contributing much valuable information and suggestions, and it is opportune here to thank each and all of these numerous contributors for their co-operation in a work of which we hope they have experienced the practical value.

The publishers will be very grateful to Architects, Contractors, Builders and Engineers who will assist them by criticizing, correcting any errors, typographical or otherwise, or suggesting any new innovation that will make *Referendex* more useful to them.

"THE REFERENDEX WAY"

A SPECIAL FEATURE.

A feature in this issue of *Referendex* is an index of all manufacturers in all lines of Building construction materials so, if information on any manufacturer or product is desired, it can be secured in this index be the manufacturer an advertiser or not.

RECIPROCITY.

When you are in the market for materials for any proposed project or structure, send us the details, you will assist us, assist our advertisers, and benefit yourself, in the long run.

INFORMATION BUREAU.

Our information Bureau covers a large field. Any information, specification or data on any line of Building construction will be forwarded to you for the asking.

We have catalogues on everything in the building line which will be sent to you on request.

THE COMING ISSUE.

Wine grows better with age similarly with our publication. Our 1915-16 issue will be a decided improvement on our previous editions in so much that in it we will incorporate new departments, good concise data on building construction and a few new innovations which we hope and expect will make *Referendex* an invaluable and useful necessity if it is not that already.

ASSISTANCE.

You as a user of *Referendex* can give considerable assistance to make this publication more valuable to you every year. Tell the manufacturer how valuable *Referendex* is, tell him it would help you more if his announcement was placed in *Referendex* giving the details of his products so that you could locate this information readily. Be a Booster, it is to your own interests.

ANNOUNCEMENT.

Recently we received a suggestion from a technical expert to get up an Index giving complete data on how to compile a specification from the information in *Referendex* Editorial and Advertising matter. We acted on this suggestion, but owing to the fact that our publication was on press we could not insert same, but will send one to each user of *Referendex* in about 30 days.

INDEX TO TEXT

For Index to Advertisers on these subjects see Index immediately following.

	PAGE
GENERAL CONDITIONS.	1-2
Architectural Terra Cotta.	68-69
Artificial Stone.	50
Bricks.	12-13-14
Building Stone.	47-48
Carpentry & Joinery.	73-74-75
Cement Specifications.	28-29-30-31
Cement (Waterproof).	32-33
Chimneys and Stacks.	283-284-285-286
Concrete Machinery.	42-43
Condulets.	205
Conservatories.	251-252
Doors and Shutters (Fireproof).	93-94-95-96
Drains and Sewer Piper.	183-184
Electric Wiring and Apparatus.	196-197
Electric Lighting Plants.	198
Elevators and Hoists.	225-226-227-228
Excavations.	5-6-7-8
Fire Alarm Systems.	197-198
Fireproof Doors and Shutters.	93-94-95-96
Fixtures (Bar and Store).	76-77
Fixtures (Gas Lighting).	193
Fireproofing Tile (Hollow).	70
Floor Construction.	153-154-155
Flooring (Wood).	153
Flooring (Cement).	153
Flooring (Hollow Tile).	153
Flooring (Cork and Rubber Tiling).	154
Flooring (Composition).	154
Flooring (Asphalt).	154
Floor Tile.	62-63
Floor Polishing and Scraping.	77
Foundations and Excavations.	5-6-7-8
Gas and Gas Fixtures.	192-193
Gas Heating.	166-167
Glass and Glazing.	117-118
Glass (Wire).	118
Glass (Bent).	118
Greenhouse Construction.	251-252
Hardware Specifications.	88-89
Heating (Gas).	166-167
Heating and Ventilation.	161-162-163-164-165-166-167
Heating (Vacuum).	162-163-164
Hoists.	225-226-227-228
Hollow Tile Fireproofing.	70
Insulation.	259-260-261-262
Interior Fittings.	76-77

	PAGE
Iron (Ornamental).....	209-210
Iron and Steel Notes.....	243-244-245-246-247-248
Jail Cells.....	209-210
Lathing, Plaster and Stucco.....	111-112-113-114-115
Laundry Machinery.....	282
Lighting (Gas Fixtures).....	192-193
Lighting Plants (Electric).....	198
Marble.....	60
Ornamental Iron.....	209-210
Paints and Varnishes.....	129-130-131
Panel Boards.....	207
Partitions (Rolling).....	266-267-268-269
Piping (Gas).....	192-193
Plastering Notes.....	111-112-113-114
Plumbing.....	182-183-184-185
Polishing and Scraping.....	77
Preservatives (Wood).....	131
Pump Notes.....	277
Refrigeration and Insulation.....	258-259-260-261-262
Reinforced Concrete.....	17-18-19-20-21-22
Rolling Partitions.....	266-267-268-269
Roofing Notes and Specifications.....	103-104-105-106-107
Roofing (Shingles).....	104
Roofing (Slate).....	103-104
Roofing (Tile).....	104-105
Roofing (Corrugated Iron).....	105-106
Roofing (Tin).....	106-107
Roofing (Felt).....	107
Safes and Vaults.....	236-237-238
Screens and Weather Strips.....	272-273
Sewer Pipes and Drains.....	183-184
Shutters (Fireproof).....	93-94-95-96
Sprinkler Equipment.....	184-185
Stacks and Chimneys.....	283-284-285-286
Steel and Iron Notes.....	243-244-245-246-247-248
Stone Masonry Clauses.....	48-49
Stone (Artificial).....	50
Store Fronts (Metal).....	210
Structural Steel and Iron.....	243-244-245-246-247-248
Stucco Notes.....	115
Terra Cotta (Architectural).....	68-69
Terra Cotta (Fireproofing).....	70
Tile (Clay).....	61-62
Tile (Flooring).....	62-63
Tile (Hollow Fireproofing).....	70
Vacuum Cleaners.....	242
Vacuum Heating.....	162-163-164
Varnish Notes.....	131
Vaults and Safes.....	236-237-238
Ventilation Specifications.....	164-165-166
Waterproof Cement.....	32-33
Weather Strips and Screens.....	272-273
Wiring (Electric).....	196-197
Wood Preservative Notes.....	131

INDEX TO ADVERTISERS

For Index to Materials see Index immediately following.

A

	PAGE
Aikenhead Architectural Metal Works.....	211
Aikenhead Hardware Co., Ltd.....	90-92-211-235
Ahern Safe Co., Ltd.....	239
Allith Manufacturing Co., Ltd.....	97-98
American Terra Cotta Co.....	72
Argenteuil Granite Co., Ltd.....	51
Asbestos Manufacturing Co., Ltd.....	108-109
Ault & Wiborg Varnish Works.....	132

B

Bate, W. B. & Co.....	148
Batts, Limited.	78-79
Bawden Machine Co., Ltd.....	279
Berry Bros., Ltd.....	134-135
Black Building Supply Co., Ltd.....	86-146
B. O. T. Mfg. Co., Ltd.....	186-187
Booth, G. & Son.....	221
Boving & Co. of Canada, Ltd.....	278

C

Canada Cement Co., Ltd.....	34
Canada Wire & Iron Goods Co.....	214-215
Canadian Art Stone Co., Ltd.....	52-53
Canadian Consolidated Rubber Co., Ltd.....	156
Canadian Ornamental Iron Co., Ltd.....	212
Canadian Rector Gas Heating Co., Ltd.....	168-169
Chalkley, R. & Son, Ltd.....	9
Chamberlain Metal Weather Strip Co., Ltd.....	274-275
Chance Brothers & Co., Ltd.....	124
Cluff Brothers.	189-190-191
Conduits Company, Limited.....	199
Consolidated Plate Glass Co., Ltd.....	119
Consumers' Gas Co. of Toronto.....	194-195
Corinthian Stone Co.....	54
Crouse-Hinds Co. of Canada, Ltd.....	206-208
Crown Metal Weather Strip Co.....	276

D

	PAGE
Dancy, R. C.....	116
Dennis Wire & Iron Works Co., Ltd.....	213
Dietzgen, Engene, Co., Ltd.....	3-4
Douglas Bros., Ltd.....	100-101
Dow's Glass Supply.....	125
Dunham, C. A. Co., Ltd.....	171-172-173-174
Dyer Fence & Supply Co., Ltd.....	216

E

Easyset Store Front System Co.....	224
Estey Bros. Co.....	218-219

G

Galt Stove & Furnace Co., Ltd.....	10
Goldie & McCulloch Co., Ltd.....	240
Goold, Shapley & Muir Co., Ltd.....	46

H

Hall, Wm. J.....	58
Harland, Wm. & Son.....	133
Hercules Waterproof Cement Co.....	40
Hobbs Mfg. Co., Ltd.....	120

I

Imperial Varnish and Color Co., Ltd.....	136-137
------------------------------------------	---------

J

Jamieson, R. C. & Co., Ltd.....	138
Jefferys, W.....	126-127
Johnson Temperature Regulating Co. of Canada, Ltd.....	175-176-177

K

Kawneer Mfg. Co., Ltd.....	222-223
Keiths, Limited.....	263

L

Lautz-Dunham Co., Ltd.....	64
Leslie, A. C., & Co., Ltd.....	110
Lickley, H. M., Ltd.....	82
Lister, R. A. & Co., Ltd.....	200-201
Lord & Burnham Co.....	253-254
Lowe Bros., Ltd.....	139
Lysaght, John, Ltd.....	110

M

	PAGE
MacArthur Concrete Pile & Foundation Co.....	11
Marbleloid Company.....	157
May-Oatway Fire Alarms, Ltd.....	202-203
McCray Refrigerator Co.....	264
Meadows, Geo. B. Co., Ltd.....	217
Miller Bros. & Sons, Ltd.....	249
Milton Pressed Brick Co., Ltd.....	15
Monarch Stone Co.....	55
Moore, Benjamin, & Co., Ltd.....	140-141-142-143
Morrison, Jas., Brass Mfg. Co., Ltd.....	188
Mosaic Tile Co.....	66-67

N

National Plate Glass & Mirror Works.....	128
New Jersey Terra Cotta Co.....	71
Northeastern Co.....	150-151

O

Ogden, J. Edward, Co.....	26-27
Ontario May-Oatway Fire Alarms, Ltd.....	202-203
Otis-Fensom Elevator Co., Ltd.....	229

P

Parke Construction Co.....	255
Penn, Wm., Stone Co.....	56
Pierson U-Bar Co.....	256-257
Powdrpaint Co., Ltd.....	144-145

R

Radio Electric Co. of Canada, Ltd.....	230-231
Reedy, H. J., Co.....	232-233
Richardson, J. E., Co.....	221
R. I. W. Damp Resisting Co., Ltd.....	146
Roberts, Fred G., & Co.....	152
Robinson Bros. Cork Co., Ltd.....	160-265
Roelofson Elevator Works.....	234
Rogers, Alfred, Ltd.....	35-36-37-38
Roman Stone Co., Ltd.....	57
Ronuk, Limited.....	149
Rutherford, Wm. & Sons Co., Ltd.....	80-81

S

	PAGE
St. Clair, H. J., Co., Ltd.....	224
Sand & Supplies, Ltd.....	39
Sanderson, Percy & Co., Ltd.....	147
Shearer, James, Co., Ltd.....	83
Sheldons, Limited.....	178-179
Siebert, Geo. E.....	72-264
Smart-Turner Machine Co., Ltd.....	280-281
Smith Marble & Construction Co., Ltd.....	65
Soss Invisible Hinge Co., Ltd.....	91
Star Expansion Bolt Co.....	26-27
Stewart, James, Mfg. Co., Ltd.....	170
Stigler Elevator Works.....	230-231
Stinson-Reeb Builders Supply Co., Ltd.....	41
Structural Steel Co., Ltd.....	250
Sun Brick Co., Ltd.....	16

T

Taylor, J. & J., Ltd.....	241
Taylor Portable Steel Derrick, Ltd.....	235
Tisdale Iron Stable Fittings Co., Ltd.....	92
Toronto Ornamental Stone Co.....	59
Toronto Plate Glass Importing Co., Ltd.....	121-122-123
Toronto Safe Works.....	241
Toronto Wire, Iron and Brass Co., Ltd.....	217
Trussed Concrete Steel Co. of Canada, Ltd.....	23-24-25-99
Tuttle & Bailey Mfg. Co., Ltd.....	180

U

Underwriters Electric Co.....	204
-------------------------------	-----

V

Van Dorn Iron Works Co.....	158-159
-----------------------------	---------

W

Watrous Engine Works Co., Ltd.....	181
Watson, Limited.....	271
Webb Lumber Co., Ltd.....	84-85
Weber Mfg. Co.....	87
Wettlaufer Bros.....	44-45
Wilson, Jas. G., Mfg. Co.....	102-270

Y

Yellin, Samuel.....	220
---------------------	-----

PRODUCT INDEX

All articles listed below are Manufactured or handled by the firms given in this Index.

Firms whose names appear in black face type are advertising in this issue. See index to advertisers, for page number of their announcement.

Firms names listed in light face type are not advertisers, though we will be glad to furnish you with catalogues of non-advertisers as well as advertisers.

For list of advertisers, see Index immediately preceding.

A

ACCUMULATORS (Electrical)
Lister, R. A., & Co., Toronto

AIR COMPRESSORS
(See Compressors, Air)

AIR WASHERS
Canadian Buffalo Forge Co., Ltd., Montreal
Polson Iron Works, Ltd., Toronto
Sheldons, Limited, Galt

AMMONIA VALVES (Fittings & Supplies)
Arctic Ice Machine Co., Canton, O.
Canadian Fairbanks-Morse Co., Ltd., Montreal
Kelths, Limited, Toronto
Linde Canadian Refrigerating Co., Montreal
Morrison Brass Mfg. Co., Ltd., Jas., Toronto
York Manufacturing Co., York, Pa.

ANCHORS (Guy)
Crouse-Hinds, Ltd., Toronto

ANCHORS (Adjusters)
Crouse-Hinds, Ltd., Toronto

ANCHORS (Screw)
Aikenhead Hardware Co., Toronto
Star Expansion Bolt Co., New York

ANGLE BEADS
Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
Cushing Bros. Co., Ltd., Calgary
Manitoba Gypsum Co., Ltd., Winnipeg
O'Neil, Wm. N. Co., Ltd., Vancouver
Pedlar People, Ltd., Oshawa
Steel & Radiation, Ltd., Toronto

ANGLES
Canadian Steel Foundries, Ltd., Montreal
Dominion Iron & Steel Co., Ltd., Montreal
Steel Company of Canada, Ltd., Hamilton

ANNUNCIATORS (Electric & Gravity)
Chapman & Walker, Ltd., Toronto
Northern Electric & Mfg. Co., Ltd., Montreal

ANNUNCIATOR SYSTEMS
Northern Electric & Mfg. Co., Ltd., Montreal
Norton Telephone Co., Toronto
Stromberg-Carlson Telephone Mfg. Co., Toronto

ANVILS
Canadian Fairbanks-Morse Co., Ltd., Montreal
Leslie, A. C., & Co., Montreal

ARCHITECTS' & ENGINEERS' OFFICE SUPPLIES

Dietzgen Co., Ltd., Eugene, Toronto
Hughes-Owens Co., Ltd., Montreal

ARCHITECTURAL ORNAMENTS (Plaster)
Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
Canadian Art Stone Co., Ltd., Toronto
Dancy, R. C., Toronto
Dominion Gypsum Co., Ltd., Winnipeg
Hoidge & Sons, Toronto
Hynes, Wm. J., Toronto
McCormack & Carroll, Toronto

ARCHITECTURAL ORNAMENTS (Sheet Metal)
Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
Canadian Ornamental Iron Co., Ltd., Toronto
Dennis Wire & Iron Works, Ltd., London
Gaudry, L. H., & Co., Ltd., Quebec
Meadows, Geo. B., Toronto
Ormsby, A. B., Co., Ltd., Toronto
Winnipeg Ceiling & Roofing Co., Ltd., Winnipeg

ARCHITECTURAL ORNAMENTS (Terra Cotta)
Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
American Terra Cotta Co., Chicago
Atlantic Terra Cotta Co., New York
Federal Terra Cotta Co., Chicago
Gibbs & Canning, Ltd., Tamworth, Eng.
Harkin, Francis & Co., Montreal
Leeds Fireclay Co., Ltd., Leeds, England
New Jersey Terra Cotta Co., New York
New York Architectural Terra Cotta Co., New York
North Western Terra Cotta Co., Chicago
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
Geo. E. Siebert, Winnipeg
Waite-Fullerton Co., Ltd., Winnipeg

ARCHITECTURAL TERRA COTTA
(See Terra Cotta, Architectural)

ART GLASS
(See Glass, Art)

ARTIFICIAL MARBLE
(See Marble, Artificial)

ARTIFICIAL STONE
(See Stone, Artificial)

ASBESTOS CEMENT SHINGLES
Asbestos Manufacturing Co., Montreal

ASBESTOS CORRUGATED SHEATHING

Asbestos Manufacturing Co., Montreal
 Canadian H. W. Johns-Manville Co., Toronto
 Eureka Mineral Wool & Asbestos Co., Toronto

ASBESTOS LUMBER

Asbestos Manufacturing Co., Montreal
 Canadian Asbestos Co., Montreal
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Carey, Philip Co., Toronto
 Winnipeg Ceiling & Roofing Co., Winnipeg

ASBESTOS MATERIALS

Aikenhead Hardware Co., Toronto
 Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
 Asbestos Mfg. Co., Ltd., Montreal
 Canadian Buffalo Forge Co., Ltd., Montreal
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Carey Mfg. Co., Phillip, Toronto
 Eureka Mineral Wool & Asbestos Co., Toronto
 Goldie, McCulloch Co., Galt
 Morrison Brass Mfg. Co., Jas., Toronto
 Ormsby Co., A. C., Toronto
 O'Neil, Wm. N. & Co., Vancouver
 Pease Foundry Co., Ltd., Toronto
 Reed, Geo. W., & Co. Montreal

ASBESTOS PACKED COCKS

Canadian Buffalo Forge Co., Ltd., Montreal
 Canadian Fairbanks-Morse Co., Ltd., Montreal
 Goldie & McCulloch Co., Ltd., Galt
 Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

ASBESTOS PAPER

Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Carey, Philip Co., Toronto
 Eureka Mineral Wool & Asbestos Co., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Roofers' Supply Co., Ltd., Toronto
 Winnipeg Ceiling & Roofing Co., Ltd., Winnipeg

ASBESTOS SHEET & PISTON PACKING

Aikenhead Hardware Co., Toronto
 Asbestos Mfg. Co., Ltd., Montreal
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Eureka Mineral Wool & Asbestos Co., Toronto

ASBESTOS STEAM PIPE AND BOILER COVERINGS

Asbestos Mfg. Co., Ltd., Montreal
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Eureka Mineral Wool & Asbestos Co., Toronto

ASBESTOS THEATRE CURTAIN

Asbestos Mfg. Co., Ltd., Montreal

ASPHALT FLOORING

(See Floors, Asphalt)

ASPHALT ROOFING

(See Roofing, Asphalt)

AUTOMATIC ELECTRIC LIGHT PLANTS

(See Electric Lighting Plants, Automatic)

AUTOMATIC SPRINKLERS

General Fire Equipment Co., Toronto
 Keiths, Limited, Toronto
 McGuire, W. J., Ltd., Toronto
 Morrison, Jas., Mfg. Co., Ltd., Toronto
 Norris, Thos., & Co., Toronto

AWNING ROLLERS

Aikenhead Hardware Co., Toronto

Manitoba Bridge & Iron Works., Ltd., Winnipeg
 Reed, Geo. W., & Co., Montreal
 Watson, Ltd., Bradford

B**BALCONIES (Iron)**

(See Iron Work, Architectural or Ornamental)

BANK FITTINGS

Aikenhead Hardware Co., Toronto
 Canada Foundry Co., Ltd., Toronto
 Batts, Limited, Toronto
 Berlin Interior Hardwood Co., Ltd., Berlin
 Burton & Baldwin Mfg. Co., Ltd., Hamilton
 Canada Wire & Iron Goods Co., Hamilton
 Canadian Office & School Furniture Co., Ltd., Preston
 Cushing Bros. Co., Limited, Calgary
 Dennis Wire & Iron Works, London
 Dominion Marble Co., Ltd., Montreal
 Dominion Ornamental Iron Co., Ltd., Toronto
 Estey Bros. Co., Montreal
 Gaudry, L. H., & Co., Ltd., Quebec
 Knight Bros. Co., Ltd., Burk's Falls
 Lautz-Dunham Co., Ltd., Toronto
 Meadows, Geo. B., Co., Toronto
 Missisquoi Marble Co., Montreal
 Mitchell, Robt., Co., Ltd., Montreal
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Rhodes-Curry Co., Ltd., Amherst, N.S.
 Tiffany Studios, New York
 Walker Bin & Store Fixture Co., Ltd., Berlin

BANK VAULTS

(See Vaults, Safe Deposit)

BAR FITTINGS

Berlin Interior Hardwood Co., Ltd., Berlin
 Blonde Lumber & Mfg. Co., Ltd., Chatham
 Burton & Baldwin Mfg. Co., Ltd., Hamilton
 Canadian Office & School Furniture Co., Ltd., Preston
 Cushing Bros. Co., Ltd., Calgary
 Knight Bros. Co., Ltd., Burk's Falls, Ont.
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Rhodes-Curry Co., Ltd., Amherst
 Rutherford & Son, Ltd., Wm., Montreal
 Walker Bin & Store Fixture Co., Ltd., Berlin
 Webb Lumber Co., Ltd., Toronto

BARS (Iron & Steel)

(See Iron & Steel Bars and Sheets)

BATHROOM ENAMELS

Berry Bros., Walkerville
 Glidden Varnish Co., Toronto
 International Varnish Co., Ltd., Toronto
 Jamieson, R. C., & Co., Ltd., Montreal
 Lowe Bros., Ltd., Toronto
 Martin-Senour Co., Ltd., Montreal
 Moore, Benjamin & Co., Ltd., Toronto
 Sanderson, Percy & Co., Ltd., Toronto

BATHROOM FITTINGS

Aikenhead Hardware Co., Toronto
 B. O. T. Mfg. Co., Ltd., Toronto
 Chance Bros. & Co., Ltd., Birmingham, England
 Cluff Mfg. Co., Toronto
 Dominion Marble Co., Montreal
 Empire Mfg. Co., Ltd., London
 Mitchell, Robt., Co., Ltd., Montreal
 Morrison Brass Mfg. Co., Jas., Toronto
 Robertson, Jas., Co., Toronto
 Standard Ideal Co., Ltd., Port Hope
 Standard Sanitary Co., Toronto

BATHROOMS COMPLETE

Cluff Bros., Toronto
 Empire Mfg. Co., Ltd., London
 Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
 Standard Ideal Co., Ltd., Port Hope
 Standard Sanitary Mfg. Co., Toronto

BATHS (Shower)

Cluff Bros., Toronto
 Dominion Marble Co., Ltd., Montreal
 Empire Mfg. Co., Ltd., Toronto
 Mitchell, Robt., Co., Ltd., Montreal
 Morrison Brass Mfg. Co., Ltd., Jas., Toronto
 Smith Marble & Construction Co., Ltd., Montreal
 Warden King, Ltd., Montreal

BEAMS (Iron & Steel)

Canadian Bridge Co., Ltd., Walkerville
 Dennis Wire & Iron Works Co., Ltd., London
 Dominion Architectural Iron Works, Ltd., Montreal
 Dominion Bridge Co., Ltd., Montreal
 Eastern Canada Steel & Iron Co., Ltd., Quebec
 Gaudry, L. H. & Co., Ltd., Quebec
 Leslie, A. C., & Co., Ltd., Montreal
 Manitoba Bridge & Iron Works, Ltd., Winnipeg
 McGregor & McIntyre, Toronto
 Sheldons, Limited, Galt
 Structural Steel Co., Montreal

BELTING (Leather)

Beardmore Belting Co., Toronto
 Canadian Fairbanks-Morse Co., Ltd., Montreal
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Federal Engineering Co., Ltd., Toronto
 Goldie & McCulloch Co., Ltd., Galt
 McLaren, J. C., Belting Co., Montreal

BILLIARD TABLES

Brunswick-Balke-Collender Co., Toronto
 May Mfg. Co., Toronto

BLACKBOARDS (Rolling)

Wilson, Jas. G., Mfg. Co., New York

BLACKBOARDS (Slate)

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Smith Marble & Construction Co., Ltd., Montreal

BLINDS

Dennis Wire & Iron Works, London
 Laidlaw, R. Co., Ltd., Toronto
 Peace Wm., Co., Ltd., Hamilton
 Watson, Limited, Bradford
 Wilson, Jas. G., Mfg. Co., New York
 Window Strip Co., Montreal

BLOCKS (Hollow Clay)

(See Hollow Building Blocks)

BLOCKS (Hollow Gypsum)

(See Hollow Building Blocks)

BLOWERS

Boving & Co. of Canada, Ltd., Toronto
 Canadian Buffalo Forge Co., Ltd., Montreal
 Canadian Fairbanks-Morse Co., Ltd., Montreal
 Sheldons, Limited, Galt

BOAT FITTINGS (Electric)

Crouse-Hinds, Ltd., Toronto

BOILER COVERINGS

(See Coverings, Pipe & Boiler)

BOILERS (Heating, Steam, Hot Water & Power)

Babcock & Wilcox, Montreal
 Berg Machinery Mfg. Co., Ltd., Toronto
 Boving Co. of Canada, Ltd., Toronto
 Canada Foundry Co., Ltd., Toronto
 Clare Bros. & Co., Ltd., Preston
 Cluff Bros., Toronto
 Dominion Radiator Co., Ltd., Toronto
 Empire Mfg. Co., Ltd., London
 Goldie & McCulloch Co., Galt

Hamilton, Wm., Co., Peterboro
 Ingles, John, Co., Toronto
 International Engineering Works, Ltd., Montreal
 Jenckes Machine Co., St. Catharines
 Leonard, E., & Sons, London
 Manitoba Bridge & Iron Works, Ltd., Winnipeg
 Marsh & Henthorn, Belleville
 McDougall Caledonian Iron Works, Ltd., Montreal
 Mussels, Limited, Montreal
 Pease Foundry Co., Ltd., Toronto
 Polsons Iron Works, Toronto
 Steel & Radiation, Ltd., Toronto
 Taylor-Forbes Co., Ltd., Guelph
 Warden, King, Ltd., Montreal
 Waterous Engine Works Co., Brantford
 Wettlaufer Bros., Toronto

BOILERS (Marine)

Berg Machinery Mfg. Co., Ltd., Toronto
 Goldie & McCulloch Co., Ltd., Galt
 Waterous Engine Works, Brantford

BOLTS (Expansion)

Aikenhead Hardware Co., Toronto
 Star Expansion Bolt Co., New York

BOLTS (Toggle)

Aikenhead Hardware Co., Toronto
 Star Expansion Bolt Co., New York

BOOK STACKS (Library, Wood)

Berlin Interior Hardwood Co., Ltd., Berlin
 Blonde Lumber & Mfg. Co., Chatham
 Burton & Baldwin Mfg. Co., Hamilton
 Canadian Office & School Furniture Co., Preston
 Knight Bros., Ltd., Burk's Falls

BOOK STACKS (Metal)

Dennis Wire & Iron Works, London
 Meadows, Geo. B., Toronto
 Snead & Co., Iron Works, Ltd., Toronto

BOOTHS

Batts, Ltd., Toronto
 Berlin Interior Hardwood Co., Ltd., Berlin
 Burton & Baldwin Mfg. Co., Hamilton
 Canadian Office & School Furniture Co., Preston
 Cushing Bros. Co., Ltd., Calgary
 Knight Bros. Co., Ltd., Burk's Falls
 Lickley, H. M., Ltd., Toronto
 Rutherford & Son, Wm., Ltd., Montreal
 Walker Bin & Store Fixture Co., Berlin
 Webb Lumber Co., Ltd., Toronto

BRACKETS (Iron & Brass)

Aikenhead Hardware Co., Toronto
 Canada Foundry Co., Ltd., Toronto
 Canadian Ornamental Iron Co., Ltd., Toronto
 Dennis Wire & Iron Works, London
 Estey Bros. Co., Montreal
 Manitoba Bridge & Iron Works, Ltd., Winnipeg
 Meadows, Geo. B., Toronto
 Mitchell, Robt., Co., Ltd., Montreal
 O'Neil, Wm. N. Co., Ltd., Vancouver

BRASS CASTINGS & LETTERS

Aikenhead Hardware Co., Toronto
 Architectural Bronze & Iron Works, Toronto
 Booth, Geo., & Son, Toronto
 Chadwick Brass Co., Ltd., Hamilton
 Dennis Wire & Iron Works, London
 Empire Mfg. Co., Ltd., London
 Estey Bros. Co., Montreal
 Gaudry, L. H., & Co., Quebec
 Morrison Jas., Brass Mfg. Co., Ltd., Toronto
 Richardson, J. E., & Co., Toronto
 Watson, Jno., & Sons, Montreal

BRASS FITTINGS (Bath & Lavatory)

Aikenhead Hardware Co., Toronto
 Cluff Bros., Toronto
 Empire Mfg. Co., Ltd., London
 Mitchell, Robt., Co., Ltd., Montreal
 Morrison, Jas., Brass Mfg. Co., Toronto

BRASS RAILS

Aikenhead Hardware Co., Toronto
 Architectural Bronze & Iron Works, Toronto
Canadian Ornamental Iron Co., Ltd., Toronto
 Chadwick Brass Co., Ltd., Hamilton
Dennis Wire & Iron Works, London
Estey Bros. Co., Montreal
 Gaudry, L. H., & Co., Ltd., Quebec
 Mitchell, Robt., & Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co. Ltd., Toronto
 O'Neil, Wm. N., & Co., Ltd., Vancouver

BRICK

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
Black Building Supply Co., Toronto
 Columbus Brick & Terra Cotta Co., Columbus, Ohio
 Dartnell, Ltd., Montreal
 Don Valley Brick Works, Toronto
 Hamilton Pressed Brick Co., Hamilton
Milton Pressed Brick Co., Milton
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Ramsay & Kelly, Montreal
Stinson-Reeb Builders' Supply Co., Montreal
Sun Brick Co., Toronto
 Waite-Fullerton Co., Ltd., Winnipeg

BRICK (Enamel or Porcelain)

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
 American Enamel Brick & Tile Co., New York
Black Building Supply Co., Toronto
 Don Valley Brick Works, Toronto
Mosaic Tile Co. of Zanesville, O., New York
Milton Pressed Brick Co., Ltd., Milton
 Ontario National Brick Co., Toronto
 Port Credit Brick Co., Port Credit
 Ramsay & Kelly, Montreal
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
 Waite-Fullerton Co., Ltd., Winnipeg

BRICK (Fire)

(See Firebrick)

BRICK (Front or Face, Pressed, Clear-Glaze, Salt Glaze)

Alsip Brick, Tile & Lumber Co., Winnipeg
 American Enamel Brick & Tile Co., New York
Black Building Supply Co., Ltd., Toronto
 Bradford Pressed Brick Co., Bradford, Pa.
 Canadian Pressed Brick Co., Ltd., Hamilton
 Dartnell, Limited, Montreal
 Dominion Marble Co., Ltd., Montreal
 Don Valley Brick Works, Toronto
 Hamilton Pressed Brick Works, Hamilton
 Hankin, Francis & Co., Montreal
 Hocking Valley Fireclay Co., Nelsonville, O.
 Leeds Fireclay Co., Ltd., Leeds, Eng.
Milton Pressed Brick Co., Ltd., Milton
 Mount Royal Brick Co., Ltd., Montreal
 Ormstown Brick Co., Ltd., Montreal
 Ramsay & Kelly, Montreal
Stinson-Reeb Builders' Supply Co., Ltd.,
Sun Brick Co., Ltd., Toronto
 Waite-Fullerton Co., Ltd., Winnipeg

BRICK (Glass)

Dartnell, Ltd., Montreal
Hobbs, Ltd., London
 Luxfer Prism Co., Toronto

BRICK (Hollow)

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
 Don Valley Brick Co., Toronto
 National Fireproofing Co., Toronto
Sun Brick Co., Ltd., Toronto
 Waite-Fullerton Co., Ltd., Winnipeg

BRICK (Radial)

Canadian Kellogg Co., Ltd., Montreal

BRIDGES (Concrete)

Noble, Clarence W., Toronto
 Steel & Radiation, Ltd., Toronto
Trussed Concrete Steel Co. Canada, Ltd., Walkerville

BRIDGES (Structural Steel)

Canada Foundry Co., Ltd., Toronto
 Canadian Bridge Co., Ltd., Walkerville
 Dominion Bridge Co., Ltd., Montreal
 Eastern Canada Steel & Iron Works, Ltd., Quebec
 Manitoba Bridge & Iron Works, Ltd., Winnipeg
 O'Neil, Wm. N., Co., Ltd., Vancouver
Structural Steel Co., Montreal

BRONZE WORKERS

(See Iron Work, Architectural or Ornamental)

BRUSHES (Weighted, Polishing, Hand)

Black Building Supply Co., Toronto
Ronuk, Limited, Toronto
Sanderson, Pearcey Co., Ltd., Toronto

BUILDERS' HARDWARE

(See Hardware, Builders')

BUILDERS' SUPPLIES

Aikenhead Hardware Co., Toronto
Black Building Supply Co., Toronto
 Braid & McCurdy, Winnipeg
 Canada Hardware, Ltd., Toronto
 Canadian Supply & Contracting Co., Toronto
 Contractors' Supply Co., Ltd., Toronto
 Cullen, E. T., Vancouver
 Hankin, Francis & Co., Montreal
 Hyde, F., & Son, Montreal
 Ontario Lime Association, Toronto
 Ramsay & Kelly, Montreal
Siebert, Geo. E., Winnipeg
 Schultz Bros., Brantford
 Smith & Ryan, Toronto
Stinson-Reeb Builders' Supply Co., Ltd., Montreal

BUILDING PAPERS (Waterproof)

Bird, F. W., & Son, Hamilton
 Brantford Roofing Co., Ltd., Brantford
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Canadian Supply & Contracting Co., Toronto
 Carey, Philip, Co., Toronto
 Eureka Mineral Wool & Asbestos Co., Toronto

BURLAPS

Alsip Brick, Tile & Lumber Co., Winnipeg
 Carey, Philip, Co., Toronto
 Elliott & Son, Ltd., Toronto
 O'Neil, Wm. N., Co., Vancouver
 Tiffany Studios, New York
 Wood Bros., Montreal

C**CABINETS (Electric Bath)**

Hill Electric Switch & Mfg. Co., Ltd., Montreal

CABINETS (Electric)

Crouse-Hinds Co., Ltd., Toronto

CABINETS (Filing)

Dietzgen, Eugene, Co., Ltd., Toronto
 Hughes-Owens Co., Ltd., Montreal

CABINETS (Medicine, Metal)

Dennis Wire & Iron Works, London
 Freek, Clarke & Co., Ltd., Toronto
Meadows, Geo. B., Toronto
 Safe Cabinet Co., Ltd., Montreal

CABINET WORK

Batts, Limited, Toronto
 Berlin Interior Hardwood Co., Ltd., Berlin
 Bromsgrove Guild (Canada), Ltd., Montreal
 Burton & Baldwin Mfg. Co. Ltd., Hamilton

CABINET WORK—Continued

Canadian Office & School Furniture Co., Ltd., Preston
Cushing Bros. Co., Ltd., Calgary
Elliott & Son, Ltd., Toronto
Green Bros., Toronto
Knight Bros. Co., Ltd., Burk's Falls
Lickley, H. M., Ltd., Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Rutherford & Son, Wm., Ltd., Montreal
Rhodes-Curry Co., Ltd., Amherst
Tiffany Studios, New York
Walker Bin & Store Fixture Co., Berlin
Webb Lumber Co., Ltd., Toronto

CABINET WORK (Wood)

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
Batts, Limited, Toronto
Berlin Interior Hardwood Co., Ltd., Berlin
Burton & Baldwin Mfg. Co., Ltd., Hamilton
Canada Lumber Co., Toronto
Cushing Bros. Co., Ltd., Calgary
Knight Bros. Co., Ltd., Burk's Falls
Lickley, H. M., Ltd., Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Plastic Relief Mfg. Co., Chicago
Rhodes-Curry Co., Ltd., Amherst
Tiffany Studios, New York
Rutherford, Wm., & Co., Montreal
Webb Lumber Co., Toronto

CAEN STONE

Dancy R. C., Toronto
Dominion Marble Co., Ltd., Montreal
Hodge & Sons, Toronto
Hynes, Wm. J., Toronto
Lautz-Dunham Co., Ltd., Toronto
Smith Marble & Construction Co., Ltd., Montreal

CAEN STONE CEMENT

Hynes, Wm. J., Toronto
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
United States Gypsum Co., Chicago

CARBOLINEUM Wood Preservative)

Carbolineum Wood Preserving Co., New York City
North Eastern Co., Boston, Mass.

CARRIERS (Ash)

Miller Bros. & Sons, Montreal
Waterous Engine Works Co., Ltd., Brantford

CARRIERS (Merchandise)

Aikenhead Hardware Co., Toronto
Allith Manufacturing Co., Hamilton

CASEMENTS (Steel)

Cullen, E. C., Vancouver
Douglas Bros., Toronto
Hope, Henry & Son, Ltd., Toronto
Gaudry, L. H., & Co., Ltd., Quebec
Ormsby, A. B., Co., Ltd., Toronto
Steel & Radiation, Ltd., Toronto
Trussed Concrete Steel Co., Ltd., Walkerville
Wragge, Geo., Ltd., Manchester, England

CASTINGS (Iron, Bronze & Builders')

Aikenhead Hardware Co., Toronto
Canada Iron Corporation, Ltd., Montreal
Canadian Locomotive Co., Ltd., Montreal
Canadian Ornamental Iron Co., Ltd., Toronto
Clare Bros. & Co., Ltd., Preston
Dennis Wire & Iron Works, London
Dominion Ornamental Iron Co., Ltd., Toronto
Estey Bros. Co., Montreal
Gaudry, L. H., & Co., Ltd., Quebec
Goldie & McCulloch Co., Ltd., Galt
Manitoba Bridge & Iron Works, Ltd., Winnipeg
McDougall Caledonian Iron Works Co., Montreal
Miller Bros. & Sons, Montreal
Mitchell, Robt., Co., Ltd., Montreal

Waterous Engine Works Co., Ltd., Brantford

CAST IRON COLUMNS

(See Columns, Cast Iron)

CEILINGS (Plaster)

Alsip Brick, Tile & Lumber Co., Winnipeg
Dancy, R. C., Toronto
Dominion Gypsum Co., Ltd., Winnipeg
Hoidge & Sons, Toronto
Hynes, Wm. J., Toronto
Plastic Relief Mfg. Co., Chicago

CEMENT

Braid & McCurdy, Winnipeg
Canada Cement Co., Ltd., Montreal
Morrison, T. A., & Co., Montreal
Ontario Lime Association, Toronto
Rogers, Alfred, Ltd., Toronto
Smyth & Ryan, Toronto
Stinson-Reeb Builders' Supply Co., Montreal

CEMENT BRICK MACHINERY

Wettlaufer Bros., Toronto

CEMENT MACHINERY

Goold, Shapley & Muir Co., Brantford
Waterous Engine Works Co., Ltd., Brantford
Wettlaufer Bros., Toronto

CEMENT COLORINGS

(See Stains, Brick, Cement, Waterproof)

CEMENT (Rubber)

Carey, Philip, Co., Toronto
Roofers' Supply Co., Ltd., Toronto

CEMETERY VAULTS (Granite, Stone & Marble)

Dominion Marble Co., Ltd., Montreal
Lautz-Dunham Co., Ltd., Toronto
Missisquoi Marble Co., Ltd., Montreal
Smith Marble & Construction Co., Ltd., Montreal

CENTRIFUGAL PUMPS

(See Pumps, Centrifugal)

CESSPOOLS

Aikenhead Hardware Co., Toronto
Empire Mfg. Co., Ltd., London
Manitoba Bridge & Iron Works, Ltd., Winnipeg
Miller Bros. & Sons, Montreal
Morrison, Jas., Brass Mfg. Co., Toronto
Warden, King, Limited, Montreal

CHAIRS (Folding)

Berlin Interior Hardwood Co., Ltd., Berlin
Blonde Lumber & Mfg. Co., Ltd., Chatham
Canadian Office & School Furniture Co., Ltd., Preston
Hankin, Francis & Co., Montreal
Stratford Mfg. Co., Ltd., Stratford

CHANDELIERS

Chadwick Brass Co., Ltd., Hamilton
Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Bras Mfg. Co., Ltd., Toronto

CHIMNEY & FLUE LININGS

Alsip Brick, Tile & Lumber Co., Winnipeg
Canadian Art Stone Co., Ltd., Toronto
Stinson-Reeb Builders' Supply Co., Ltd., Montreal

CHIMNEY POTS (Fireclay)

Alsip Brick & Tile Co., Winnipeg
Hankin, Francis & Co., Montreal
Stinson-Reeb Builders' Supply Co., Ltd., Montreal

CHIMNEYS (Concrete)

Canadian Art Stone Co., Ltd., Toronto
Canadian Kellogg Co., Ltd., Montreal
Laurie & Lamb, Montreal
Roman Stone Co., Ltd., Toronto
Wettlaufer Bros., Toronto

CONTRACTORS' EQUIPMENT—Continued
Stinson-Reeb Builders' Supply Co., Ltd.,
Montreal
Taylor Portable Steel Derrick Co., To-
ronto
Wettlaufer Bros., Toronto

CONVEYING MACHINERY
 Beamis, Ed., & Co., Little Hulton, Bolton,
 Eng.
 Beath, W. D., & Son, Ltd., Toronto
Boving & Co. of Canada, Ltd., Toronto
 Canadian Fairbanks-Morse Co., Ltd.,
 Montreal
 Jeffrey Mfg. Co., Columbus
 Manitoba Bridge & Iron Works, Ltd.,
 Winnipeg
 Metcalf, Jno. S., Co., Ltd., Montreal
Miller Bros. & Sons, Montreal
 Peacock Bros., Montreal
 Royce, Limited, Toronto
Waterous Engine Works, Brantford

COOKING EQUIPMENT (Gas)
 Consumers' Gas Co., Toronto

COPPER WORKERS
Aikenhead Hardware Co., Toronto
Kawneer Mfg. Co., Ltd., Toronto
 Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Toronto
 Ormsby, A. B., Co., Ltd., Toronto
St. Clair, H. J., Co., Toronto
 Winnipeg Ceiling & Roofing Co., Ltd.,
 Winnipeg

CORK BOARDS
 Canadian H. W. Johns-Manville Co., Ltd.,
 Toronto
 Carey, Phillip & Co., Toronto
 Kent Co., Ltd., Montreal
 O'Neil, Wm. N., Co., Ltd., Vancouver
Robinson Bros. Cork Co., Toronto

CORK FLOOR TILING
 Dominion Marble Co., Ltd., Montreal
 Kennedy, David E., Inc., Montreal
Robinson Bros. Cork Co., Ltd., Toronto

CORK INSULATION
 Armstrong Cork Co., Ltd., Montreal
 Canadian H. W. Johns-Manville Co., Ltd.,
 Toronto
 Kennedy, David E., Inc., Montreal
Robinson Bros. Cork Co., Toronto

CORNER BARS
 Canadian Store Front Co., Hamilton
 Hobbs Mfg. Co., Ltd., London
Kawneer Mfg. Co., Toronto
 Snead & Co., Iron Works, Ltd., Toronto
St. Clair, H. J., Co., Toronto

CORNICES (Metal)
Douglas Bros., Toronto
 Gaudry, L. H., & Co., Ltd., Quebec
 Ormsby, A. B., Co., Ltd., Toronto
 Pedlar People, Ltd., Oshawa
 Watson, Jno. & Son, of Montreal, Ltd.,
 Montreal
 Winnipeg Ceiling & Roofing Co., Ltd.,
 Winnipeg

CORNICES (Plaster)
Dancy, R. C., Toronto
 Dominion Gypsum Co., Ltd., Winnipeg
 Hoidge & Sons, Toronto
 Hynes, Wm. J., Toronto

CORRUGATED IRON
 Alsip Brick, Tile & Lumber Co., Ltd.,
 Winnipeg
Douglas Bros., Toronto
 McClary Mfg. Co., London
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Ormsby, A. B., Co., Ltd., Toronto
 Pedlar People, Ltd., Oshawa
 Watson, Jno., & Son, of Montreal, Ltd.,
 Montreal

CORRUGATED STEEL BARS
 Beath, W. D., & Son, Ltd., Toronto

Church, Ross & Co., Montreal
Dyer Fence & Supply Co., Toronto
 Noble, Clarence W., Toronto
Trussed Concrete Steel Co. of Canada,
Ltd., Walkerville

COUNTERS
 (See Office Furnishings)

COVERINGS (Pipe & Boiler)
Asbestos Mfg. Co., Ltd., Montreal
 Canadian Fairbanks-Morse Co., Ltd.,
 Montreal
 Canadian H. W. Johns-Manville Co., Ltd.,
 Toronto
 Carey, Phillip, Co., Toronto
 Dominion Radiator Co., Ltd., Toronto
 Eureka Mineral Wool & Asbestos Co.,
 Toronto
 Morrison & Dagnall, Montreal
 Pease Foundry, Ltd., Toronto
 Steel & Radiation, Ltd., Toronto

CRANES
Aikenhead Hardware Co., Toronto
 Babcock & Wilcox, Montreal
 Beath, W. D., & Son, Toronto
Boving & Co. of Canada, Ltd., Toronto
 Brown Hoisting Machinery Co., Cleveland
 Canadian Allis-Chalmers Co., Ltd., Mont-
 real
 Canadian Bridge Co., Walkerville
 Canadian Fairbanks-Morse Co., Ltd.,
 Montreal
 Dominion Bridge Co., Ltd., Montreal
 Drummond, McCall & Co., Montreal
 Hepburn, Jno. T., Ltd., Toronto
 Hopkins, F. H., & Co., Montreal
 Mussels, Ltd., Montreal
Smart-Turner Machine Co., Ltd., Hamilton
Taylor Portable Steel Derrick Co., To-
ronto

CREOSOTE
 Carbolineum Wood Preserving Co., New
 York
Northeastern Co., Boston, Mass.
Sanderson, Percy & Co., Ltd., Toronto

CRUSHED STONE
 (See Stone, Crushed)

CULVERTS
 Church-Ross & Co., Montreal
 Pedlar People, Ltd., Oshawa

D

DAMPER REGULATORS
 Canadian Fairbanks-Morse Co., Ltd.,
 Montreal
 Canadian Powers Regulator Co., Ltd., To-
 ronto
 Clare Bros. & Co., Ltd., Preston
 Dominion Radiator Co., Ltd., Toronto
Goldie & McCulloch Co., Ltd., Galt
Galt Stove & Furnace Co., Galt
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto

DECORATION
 Alabastine Co., Ltd., Paris
Dancy, R. C., Toronto
 Dominion Marble Co., Ltd., Montreal
 Elliott & Son, Ltd., Toronto
Roberts, Fred. G., & Co., Toronto
 Tiffany Studios, New York
 Wood Bros., Montreal

DEPOSIT BOXES (Safe)
Ahern Safe Co., Ltd., Montreal
 Dominion Safe & Vault Co., Ltd., Farn-
 ham
Goldie & McCulloch, Galt
 O'Neil, Wm. N., Co., Ltd., Vancouver
Taylor, J. & J., Ltd., Toronto

DERRICKS & DERRICK FITTINGS
 American Hoist & Derrick Co., St. Paul
 Beatty, M., & Sons, Ltd., Welland
 Dominion Bridge Co., Ltd., Montreal
 Hepburn, Jno. T., Toronto

DERRICKS AND DERRICK FITTINGS—Continued

Hopkins & Co., F. H., Montreal
Ideal Concrete Machinery Co., London
London Concrete Machinery Co., London
Mussens, Ltd., Montreal
Taylor Portable Steel Derrick Co., Toronto

DESKS

Berlin Interior Hardwood Co., Ltd., Berlin
Burton & Baldwin Mfg. Co., Ltd., Hamilton
Canadian Office & School Furniture Co., Ltd., Preston
Knight Bros. & Co., Ltd., Burk's Falls
Rhodes-Curry Co., Ltd., Amherst

DIRECTORY BOARDS (Bronze & Iron)
Estey Bros. Co., Montreal

DIVISION BARS

Canadian Store Front Co., Hamilton
Consolidated Plate Glass Co., Toronto
St. Clair, H. J., Co., Toronto
Kawneer Mfg. Co., Toronto
Hobbs Mfg. Co., Ltd., London

DOORS (Bronze)

Architectural Bronze & Iron Works, Ltd., Toronto
Canadian Ornamental Iron Co., Ltd., Toronto
Dennis Wire & Iron Works Co., Ltd., London
Dominion Ornamental Iron Co., Ltd., Toronto
Estey Bros. Co., Montreal
Gaudry, L. H., & Co., Ltd., Quebec
Meadows, Geo. B., Toronto
Mitchell, Robt., Co., Ltd., Montreal
Tiffany Studios, New York
Yellin, Samuel, Philadelphia

DOORS (Fireproof & Metal)

Ahern Safe Co., Ltd., Montreal
Aikenhead Hardware Co., Ltd., Toronto
Allith Mfg. Co., Hamilton
Alsip Brick, Tile & Lumber Co., Winnipeg
Canadian Ornamental Iron Co., Ltd., Toronto
Dennis Wire & Iron Works, London
Douglas Bros., Toronto
Goldie & McCulloch Co., Galt
Kinnear Mfg. Co., Columbus, Ohio
Manitoba Bridge & Iron Works, Ltd., Winnipeg
Meadows, Geo. B., Toronto
Pedlar People, Ltd., Oshawa
Steel & Radiation, Ltd., Toronto
Stinson-Reeb Builders' Supply Co., Montreal
Taylor, J. & J., Ltd., Toronto
Van Dorn Mfg. Co., Cleveland

DOORS (Freight Elevator, Passenger)

Ormsby, A. B., Co., Ltd., Toronto
Otis-Fensom Elevator Co., Toronto

DOORS (Iron)

Ormsby, A. B., Co., Ltd., Toronto
Wilson, Jas. G., Mfg. Co., New York

DOORS (Refrigerator & Cold Storage)

Jones Cold Store Door Co., Hagerstown, Md.
McCrary Refrigerator Co., Kendallville, Ind.

DOORS (Revolving)

Canadian Revolving Door Co., Toronto
Dominion Revolving Door Co., Montreal

DOORS (Screen)

Peace, Wm. Co., Ltd., Hamilton
Watson, Limited, Bradford
Window Strip Co., Montreal

DOORS (Steel Rolling)

Kinnear Mfg. Co., Ltd., Columbus, Ohio
Ormsby, A. B., Co., Ltd., Toronto
Wilson, Jas. G., Mfg. Co., New York

DOORS (Vault)

Ahern Safe Co., Ltd., Montreal
Dominion Safe & Vault Co., Ltd., Farnham, Que.
Goldie & McCulloch Co., Galt
Taylor, J. & J., Co., Toronto

DOORS (Wood & Veneered)

Alsip Brick, Tile & Lumber Co., Winnipeg
Batts, Limited, Toronto
Benson & Bray, Ltd., Montreal
Blonae Mfg. Co., Ltd., Chatham
Boak Mfg. Co., Ltd., Toronto
Burton & Baldwin Mfg. Co., Ltd., Hamilton
Canada Lumber Co., Ltd., Toronto
Cushing Bros. Co., Ltd., Toronto
Davidson, Jas., Ottawa
Georgian Bay Shook Mills, Ltd., Midland
Knight Bros. Co., Ltd., Burk's Falls
Laidlaw Lumber Co., Toronto
Lickley, H. M., Ltd., Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Powell Lumber & Door Co., Ltd., Toronto
Rhodes-Curry Co., Ltd., Amherst
Rutherford, Wm., & Sons Co., Ltd., Montreal
Shearer, Jas., Co., Ltd., Montreal
Webb Lumber Co., Ltd., Toronto

DRAINERS (Cellar)

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
Cluff Bros., Toronto

DRAWING INSTRUMENTS & MATERIALS

Aikenhead Hardware Co., Toronto
Dietzgen Co., Ltd., Eugene, Toronto

DRILLS

Aikenhead Hardware Co., Ltd., Toronto
Beatty, M., & Sons, Welland
Canadian Allis-Chalmers, Ltd., Montreal
Canadian Buffalo Forge Co., Ltd., Montreal
Canadian Ingersoll-Rand Co., Montreal
Drury, H. A., Co., Ltd., Montreal
Hopkins, F. H., & Co., Montreal
Lecky & Collis, Montreal
Mussens, Ltd., Montreal
Star Expansion Bolt Co., New York

DRINKING FOUNTAINS (Artificial Stone)

Canadian Art Stone Co., Ltd., Toronto
Corinthian Stone Co., Ltd., Guelph
Monarch Stone Co., Ltd., Toronto
Roman Stone Co., Ltd., Toronto
Toronto Ornamental Stone Co., Ltd., Toronto

DRINKING FOUNTAINS (Bronze, Cast Iron)

Canadian Ornamental Iron Co., Ltd., Toronto
Dennis Wire & Iron Works, London
Dominion Ornamental Iron Co., Ltd., Toronto
Estey Bros. Co., Montreal
Meadows, Geo. B., Toronto

DRINKING FOUNTAINS (Hardware)

Hall, W. J., Toronto

DRINKING FOUNTAINS (Marble)

Dominion Marble Co., Montreal
Hoidge Marble Co., Toronto
Lautz-Dunham Co., Toronto
Missisquoi Marble Co., Ltd., Montreal
Smith Marble & Construction Co., Ltd., Montreal

DRINKING FOUNTAINS (Porcelain Enamelled)

Cluff Bros. Toronto
Robertson, Jas., Co., Montreal
Standard Ideal Co., Ltd., Port Hope
Standard Sanitary Co., Ltd., Toronto

DRYERS (Paint)

Berry Bros., Walkerville
Glidden Varnish Co., Toronto
Harland, Wm., & Co., Toronto
Imperial Varnish Co., Ltd., Toronto

DRYERS (Paint)—Continued

International Varnish Co., Ltd., Toronto
 Jamieson, R. C., & Co., Ltd., Montreal
 Langmuir, Jas., Co., Ltd., Toronto
 Lowe Bros., Ltd., Toronto
 Martin-Senour Co., Ltd., Montreal
 Moore, Benj., & Co., Toronto
 Pratt & Lambert, Bridgeburg

DRYING APPLIANCES

Canadian Buffalo Forge Co., Ltd., Montreal
 Canadian Rector Gas Heating Co., Ltd., Hamilton
 Sheldons, Limited, Galt

DRY KILN DOOR CARRIERS

Allith Mfg. Co., Ltd., Hamilton
 Ormsby, A. B., Co., Ltd., Toronto
 Van Dorn Mfg. Co., Cleveland

DUMB WAITERS

Aikenhead Hardware Co., Toronto
 Otis-Fensom Elevator Co., Ltd., Toronto
 Roelofson Elevator Works, Galt
 Sedgwick Machine Works, Poughkeepsie
 Turnbull Elevator Mfg. Co., Toronto

E**ELECTRICAL CONTRACTORS**

Beattie, G. J., Toronto
 Rogers Electrical Company, Ltd., Toronto
 Underwriters Electric Co., Montreal

ELECTRICAL ENGINEERS

Keiths, Limited, Toronto
 Lister, R. A., & Co., Toronto
 Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
 Stuart, Drinkwater & Hingston, Ltd., Montreal

ELECTRICAL SUPPLIES

Canada Foundry Co., Ltd., Toronto
 Canadian Fairbanks-Morse Co., Ltd., Montreal
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Canadian Tungsten Lamp Co., Ltd., Hamilton
 Conduits Co., Ltd., Toronto
 Crouse-Hinds Co., Ltd., Toronto
 Hill Electric Switch & Mfg. Co., Montreal
 Northern Electric & Mfg. Co., Ltd., Montreal
 Pearce, M. S., & Co., Toronto

ELECTRIC CANDLE LAMPS

Canada Foundry Co., Ltd., Toronto
 Canadian Tungsten Lamp Co., Ltd., Hamilton
 Northern Electric & Mfg. Co., Ltd., Montreal

ELECTRIC LAMPS (Tungsten)

Canada Foundry Co., Ltd., Toronto
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Canadian Sunbeam Lamp Co., Ltd., Toronto
 Canadian Tungsten Lamp Co., Ltd., Hamilton
 Lister, R. A., & Co., Toronto
 Pierce, M. S., & Co., Toronto
 Stuart, Drinkwater & Hingston, Ltd., Montreal

ELECTRIC LIGHT FIXTURES

Canada Foundry Co., Ltd., Toronto
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Canadian Tungsten Lamp Co., Ltd., Hamilton
 Chadwick Brass Co., Ltd., Hamilton
 Colonial Fixture Co., Ltd., Toronto
 Elliott & Son, Ltd., Toronto
 Hankin, Francis & Co., Montreal
 Holophane Co., Ltd., Toronto
 Jefferson Glass Co., Ltd., Toronto
 Lister, R. A., & Co., Toronto
 McDonald & Wilson, Ltd., Toronto

Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
 Northern Electric & Mfg. Co., Ltd., Montreal
 Tiffany Studios, New York
 Tungstolier Co., Ltd., Toronto

ELECTRIC LIGHTING PLANTS (Automatic)

Lister, R. A., & Co., Toronto

ELECTRIC LIGHTING PLANTS (Engine & Water Power)

Lister, R. A., & Co., Toronto

ELECTRIC MARBLE

Dominion Marble Co., Ltd., Montreal
 Hoidge Marble Co., Toronto
 Lautz-Dunham Co., Toronto
 Missisquoi Marble Co., Ltd., Montreal
 Smith Marble & Construction Co., Ltd., Montreal

ELECTRIC WIRES & CABLES

(See Wire & Cable, Electric)

ELECTRIC WIRING CONTRACTORS

Mitchell, Robt., Co., Ltd., Montreal
 Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

Underwriters' Electric Co., Ltd., Montreal

ELECTROPLATING

Aikenhead Hardware Co., Toronto
 Clare Bros. & Co., Ltd., Preston
 Dennis Wire & Iron Works Co., Ltd., London
 Gaudry, L. H., & Co., Ltd., Quebec
 Meadows, Geo. B., Toronto
 Mitchell, Robt., Co., Ltd., Montreal
 Morrison, Jas., Brass Mfg. Co., Toronto

ELEVATOR DOOR LOCKS

(See Locks, Elevator Doors)

ELEVATORS (Passenger & Freight)

Goldie & McCulloch Co., Galt
 McLaughlin Elevators, Ltd., Montreal
 Otis-Fensom Elevator Co., Ltd., Toronto
 Radio Electric Co. of Canada, Ltd., Montreal
 Reedy, H. J., Co., Cincinnati
 Roelofson Elevator Works, Galt
 Sedgwick Machine Works, Poughkeepsie
 Stuart, Drinkwater & Hingston, Ltd., Montreal
 Turnbull Elevator Co., Toronto
 Watrous Engine Works Co., Ltd., Brantford

ELEVATOR ENCLOSURES

Aikenhead Hardware Co., Toronto
 Canada Wire & Iron Goods Co., Hamilton
 Canadian Ornamental Iron Co., Toronto
 Estey Bros. Co., Montreal
 Dyer Fence & Supply Co., Toronto
 Dennis Wire & Iron Works, London
 Gaudry, L. H., & Co., Ltd., Quebec
 Manitoba Bridge & Iron Works, Winnipeg
 Meadows, Geo. B., Toronto
 Otis-Fensom Elevator Co., Ltd., Toronto
 Reedy, H. J., & Co., Cincinnati
 Turnbull Elevator Mfg. Co., Toronto

ENAMEL (Aluminum)

Lowe Bros., Ltd., Toronto
 Randall Bros., London, England

ENAMEL (Concrete)

Electric Paint & Varnish Co., Cleveland
 Master Builders' Co., Toronto
 Pratt & Lambert, Bridgeburg
 Trussed Concrete Steel Co., Canada, Ltd., Walkerville

ENAMEL PAINTS

Aikenhead Hardware Co., Toronto
 Ault & Wiborg Co., Toronto
 Berry Bros., Walkerville
 Brandram-Henderson Co., Montreal
 Dartnell, E. F., Ltd., Montreal
 Dominion Paint Works, Ltd., Walkerville
 Electric Paint & Varnish Co., Cleveland
 Glidden Varnish Co., Toronto

ENAMEL PAINTS—Continued

Harland, Wm., & Co., Toronto
Imperial Varnish & Color Co., Toronto
International Varnish Co., Toronto
Jamieson, R. C., & Co., Ltd., Montreal
Langmuir, Jas., & Co., Ltd., Toronto
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Moore, Benj., & Co., Ltd., Toronto
Patton Paint Co., Newark
Pinchin, Johnson Co., Toronto
Pratt & Lambert, Bridgeburg
Randall Bros., London, England
Sanderson, Percy & Co., Ltd., Toronto
Sturgeons, Limited, Toronto

ENAMEL (Radiator)

Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Pratt & Lambert, Bridgeburg
Sturgeons, Ltd., Toronto

ENAMELLED BRICK

(See Brick Enamel or Porcelain)

ENGINEERING SUPPLIES

Beath, W. D., & Son, Ltd., Toronto
Berg Machinery Mfg. Co., Ltd., Toronto
Canadian Buffalo Forge Co., Ltd., Montreal
Conduits Co., Ltd., Toronto
Dominion Radiator Co., Ltd., Toronto
Goldie & McCulloch Co., Ltd., Galt
Kerr Engine Co., Ltd., Walkerville
Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
Pease Foundry Co., Ltd., Toronto
Sheldons, Ltd., Galt
Steel & Radiation, Ltd., Toronto

ENGINEERS (Electrical)

(See Electrical Engineers)

ENGINEERS (Illuminating)

Consumers' Gas Co., Toronto
Fehr Bros., Montreal
Keiths, Ltd., Toronto
Lister, R. A., & Co., Toronto
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

ENGINEERS OR CONTRACTORS (Building)

Shearer, Jas., & Co., Montreal
Standard Structural Co., Ltd., Toronto

ENGINES

Berg Machinery Mfg. Co., Ltd., Toronto
Boving & Co. of Canada, Ltd., Toronto
Canada Foundry Co., Ltd., Toronto
Canadian Buffalo Forge Co., Ltd., Montreal
Canadian Fairbanks-Morse Co., Ltd., Montreal
Canadian Sirocco Co., Windsor
Consumers' Gas Co., Toronto
Goldie & McCulloch, Ltd., Galt
Goold, Shapley & Muir Co., Ltd., Brantford
Hopkins, F. H., & Co., Montreal
Ideal Concrete Machinery Co., Ltd., London
Ingles, Jno., Co., Toronto
International Engineering Works, Ltd., Montreal
Jenckes Machine Co., St. Catharines
Laurie & Lambe, Montreal
Leonard, E., & Sons, London
Lister, R. A., & Co., Toronto
London Concrete Machinery Co., Ltd., London
Mussens, Limited, Montreal
Peacock Bros., Montreal
Sheldons, Limited, Galt
Sturtevant, B. F., Co. of Canada, Ltd., Montreal
Waterous Engine Works, Brantford
Wettlaufer Bros., Toronto

EXHAUST FANS

Canadian Buffalo Forge Co., Ltd., Montreal

Canadian Fairbanks-Morse Co., Ltd., Montreal
Goldie & McCulloch Co., Ltd., Galt
Northern Electric & Mfg. Co., Ltd., Montreal
Sheldons, Limited, Galt

EXHAUST HEADS

Canadian Buffalo Forge Co., Ltd., Montreal
Canadian Fairbanks-Morse Co., Ltd., Montreal
Dominion Radiator Co., Ltd., Toronto
Pease Foundry, Ltd., Toronto
Polson Iron Works, Ltd., Toronto
Sheldons, Limited, Galt
Sturtevant, B. F., Co. of Canada, Ltd., Montreal

EXPANDED METAL

Beath, W. D., & Son, Ltd., Toronto
Church, Ross & Co., Montreal
Gaudry, L. H., Co., Ltd., Quebec
Manitoba Bridge & Iron Works, Ltd., Winnipeg
Manitoba Gypsum Co., Ltd., Winnipeg
Noble, Clarence W., Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Ormsby, A. B., Co., Toronto
Pedlar People, Ltd., Oshawa
Steel & Radiation, Ltd., Toronto
Trussed Concrete Steel Co. of Canada, Ltd., Walkerville

EXPANDED METAL LATH

(See Expanded Metal)

EXPANSION JOINTS

Dominion Radiator Co., Ltd., Toronto
Mitchell, Robt., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

EXPANSION TANKS

Dominion Radiator Co., Ltd., Toronto
Goldie & McCulloch Co., Ltd., Galt
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
Pease Foundry Co., Ltd., Toronto
Steel & Radiation, Ltd., Toronto

F

FAIENCE (Terra Cotta)

(See Terra Cotta, Architectural)

FANS (Electric)

Canada Foundry Co., Ltd., Toronto
Canadian Buffalo Forge Co., Ltd., Montreal
Miller Bros. & Sons, Montreal
Northern Electric & Mfg. Co., Ltd., Montreal
Polson Iron Works, Ltd., Toronto
Sheldons, Limited, Galt

FANS (Propeller)

Canadian Buffalo Forge Co., Ltd., Montreal
Polson Iron Works, Ltd., Toronto
Sheldons, Limited, Galt

FANS (Steam)

Sheldons, Limited, Galt

FANS (Steel Plate)

Polson Iron Works, Ltd., Toronto
Sheldons, Limited, Galt

FANS (Ventilating)

Canadian Buffalo Forge Co., Ltd., Montreal
Canadian Fairbanks-Morse Co., Ltd., Montreal
Miller Bros. & Sons, Montreal
Northern Electric & Mfg. Co., Ltd., Montreal
Polson Iron Works, Ltd., Toronto
Sheldons, Limited, Galt

FAUCETS

Aikenhead Hardware Co., Toronto
Cluff Bros., Toronto
 Empire Mfg. Co., Ltd., London
 Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
 Standard Ideal Co., Ltd., Port Hope
 Standard Sanitary Co., Ltd., Toronto

FEED WATER FILTERS, HEATERS, ETC.

Canada Foundry Co., Ltd., Toronto
 Canadian Fairbanks-Morse Co., Ltd., Montreal
Goldie & McCulloch, Ltd., Galt
 Laurie & Lambe, Montreal
 Manitoba Bridge & Iron Works, Ltd., Winnipeg

FELT (Deadening)

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
 Bird, F. W., & Son, Hamilton
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Carey, Philip Co., Toronto

FELT (Roofing)

Aikenhead Hardware Co., Toronto
 Bird, F. W., & Son, Hamilton
 Brantford Roofing Co., Brantford
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Canadian Supply & Contracting Co., Toronto
 Carey, Phillip, Co., Toronto
 Eureka Mineral Wool & Asbestos Co., Toronto
 MacArthur, Alex., & Co., Ltd., Montreal
 Ormsby, A. B., Co., Ltd., Toronto

FENCING (Iron & Wire)

Aikenhead Architectural Metal Works, Toronto
 Canadian Ornamental Iron Co., Ltd., Toronto
 Estey Bros. Co., Montreal
 Dyer Fence & Supply Co., Toronto
 Dennis Wire & Iron Co., London
 Dominion Ornamental Iron Co., Toronto
 Meadows, Geo. B., Co., Toronto

FENDERS

(See Iron Works, Architectural or Ornamental)

FILLERS

Berry Bros., Toronto
 Dominion Paint Works, Ltd., Walkerville
 Gidden Varnish Co., Toronto
Imperial Varnish & Color Co., Ltd., Toronto
 International Varnish Co., Ltd., Toronto
Lowe Bros., Ltd., Toronto
 Martin-Senour Co., Ltd., Montreal
 Montreal Paint & Glass Co., Montreal
Moore, Benj., & Co., Ltd., Toronto
 Patton Paint Co., Newark
 Pinchin, Johnson & Co. (Canada), Ltd., Toronto
 Pratt & Lambert, Bridgeburg
 Randall Bros., London, England
Sanderson, Percy & Co., Ltd., Toronto
 Sturgeons, Ltd., Toronto

FILTERS (Oil & Water)

Aikenhead Hardware Co., Ltd., Toronto
 Bell Filtration Co. of Canada, Ltd., Toronto
 Canadian Fairbanks-Morse Co., Ltd., Montreal
 Drummond-McCall & Co., Montreal
 Hankin, Francis & Co., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
 New York Continental Jewel Filtration Co., Montreal

FINIALS

Cushing Bros. Co., Ltd., Calgary
 Ludowici-Celadon Co., Chicago
 O'Neil, Wm. N., Co., Ltd., Vancouver

Pedlar People, Ltd., Oshawa
 Roofers' Supply Co., Ltd., Toronto
 Watson, Jno., & Son, of Montreal, Ltd., Montreal

FINIALS (Wood)

Batts, Ltd., Toronto
 Cushing Bros. Co., Ltd., Calgary
 Knight Bros. Co., Ltd., Burk's Falls
Lickley, H. M., Ltd., Toronto
Rutherford, Wm., & Son, Ltd., Montreal
Webb Lumber Co., Ltd., Toronto

FIRE ALARMS

Ontario May-Oatway Co., Toronto

FIREBRICK

Dartnell, Ltd., Montreal
 Gibb, Alexander, Montreal
Goldie & McCulloch Co., Ltd., Galt
 Hankin, Francis & Co., Montreal
Leslie, A. J., & Co., Montreal
 Ontario Lime Co., Ltd., Toronto
 Siebert, Geo. E., Winnipeg
 Smith & Ryan, Toronto
Stinson-Reeb Builders' Supply Co., Montreal
 Tennant, C., Sons & Co., Ltd., Montreal
 Waite-Fullerton Co., Ltd., Winnipeg

FIRE BUCKETS & TANKS

McClary Mfg. Co., London
 Ormsby, A. B., Co., Ltd., Toronto

FIRE DOOR HARDWARE & FITTINGS

Aikenhead Architectural Metal Works, Toronto
Aikenhead Hardware Co., Toronto
Allith Mfg. Co., Ltd., Hamilton
 Ormsby, A. B., Co., Toronto
 Richards-Wilcox Mfg. Co., London
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
Van Dorn Iron Works Co., Cleveland
 Watson, Jno., & Son, of Montreal, Ltd., Montreal

FIREDOORS

Allith Mfg. Co., Hamilton
Douglas Bros., Toronto
 Feather & Roadhouse, Toronto
 Ormsby, A. B., Co., Ltd., Toronto
Van Dorn Iron Works Co., Cleveland

FIRE ESCAPES

Aikenhead Architectural Metal Works, Toronto
Aikenhead Hardware Co., Toronto
Canadian Ornamental Iron Co., Ltd., Toronto
Dennis Wire & Iron Co., Ltd., London
 Dominion Ornamental Iron Co., Ltd., Toronto
 Eberhard-Wood Mfg. Co., Ltd., Toronto
 Hankin, Francis & Co., Montreal
 McGregor & McIntyre, Toronto
Meadows, Geo. B., Toronto
 Reid & Brown, Toronto

FIRE EXTINGUISHERS

Canadian Consolidated Rubber Co., Montreal
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 General Fire Equipment Co., Toronto
 General Fire Extinguisher Co., Toronto
 Mitchell, Robt., Co., Ltd., Montreal
May-Oatway Co., Ltd., Toronto
 Norris, Thos., Ltd., Toronto
 Ormsby, A. B., Ltd., Toronto
 Vogel Co. of Canada, Ltd., Montreal

FIRE FIGHTING APPARATUS

Ontario May-Oatway, Ltd., Toronto
Waterous Engine Works Co., Brantford

FIRE IRONS (Fenders & Baskets)

Canadian Ornamental Iron Co., Ltd., Toronto
 Chadwick Brass Co., Ltd., Hamilton
Dennis Wire & Iron Works Co., Ltd., London

FIRE IRONS (Fenders and Baskets)—Continued

Estey Bros. Co., Montreal
Meadows, Geo. B., Toronto
Mitchell, Robt., Co., Ltd., Montreal
O'Neil, Wm. N., Co., Ltd., Vancouver

FIREPLACE EQUIPMENT

Aikenhead Hardware Co., Toronto
Architectural Bronze & Iron Works, Toronto
Canadian Ornamental Iron Co., Toronto
Cadwick Brass Co., Ltd., Hamilton
Dennis Wre & Iron Works, London
O'Neil, Wm. N., Co., Vancouver
Watson, Jno., & Son, of Montreal, Ltd., Montreal

FIRE PLACES

Don Valley Brick Works, Toronto
Milton Pressed Brick Co., Toronto
Waite-Fullerton Co., Ltd., Winnipeg

FIRE PREVENTION MATERIALS

Asbestos Mfg. Co., Ltd., Montreal
Eureka Mineral Wool & Asbestos Co., Toronto
General Fire Equipment Co., Ltd., Toronto
May-Oatway Co., Toronto

FIREPROOF BUILDING BLOCKS

Braid & McCurdy, Winnipeg
Crown Gypsum Co., Ltd., Lythmore
Dominion Gypsum Co., Ltd., Winnipeg
Manitoba Gypsum Co., Ltd., Winnipeg
United States Gypsum Co., Ltd., Chicago
Waite-Fullerton Co., Ltd., Winnipeg

FIREPROOF DOORS

(See Doors, Fireproof Metal)

FIREPROOFING (Concrete)

Beath, W. D., & Son, Ltd., Toronto
Church, Ross & Co., Montreal
Dyer Fence & Supply Co., Toronto
Noble, Clarence W., Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Pedlar People, Ltd., Oshawa
Steel & Radiation, Ltd., Toronto
Stinson-Reeb Builders' Supply Co., Montreal
Trussed Concrete Steel Co. of Canada, Ltd., Walkerville

FIREPROOFING (Plaster Block)

Alabastine Co. Paris, Ltd., Paris, Ont.
Alsip Brick, Tile & Lumber Co., Winnipeg
Carey, Philip, Co., Toronto
Crown Gypsum Co., Ltd., Lythmore
Manitoba Gypsum Co., Ltd., Winnipeg
Stinson-Reeb Builders' Supply Co., Montreal
United States Gypsum Co., Chicago

FIREPROOFING (Terra Cotta)

Don Valley Brick Co., Ltd., Toronto
National Fireproofing Co., Ltd., Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
Sun Brick Co., Toronto

FIREPROOF WINDOWS AND SHUTTERS

Allith Mfg. Co., Hamilton
Alsip Brick, Tile & Lumber Co., Winnipeg
Douglas Bros., Toronto
Gaudry, L. H., Co., Ltd., Quebec
Kinneair Mfg. Co., Columbus, Ohio
O'Neil, Wm. N., Co., Ltd., Vancouver
Ormsby, A. B., Co., Ltd., Toronto
Pedlar People, Ltd., Oshawa
Richards-Wilcox Mfg. Co., London
Steel & Radiation, Ltd., Toronto
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
Trussed Concrete Steel Co. of Canada, Ltd., Walkerville

FITTINGS (Iron Pipe)

Canadian Kellogg Co., Ltd., Montreal
Cluff Bros., Toronto
Dominion Radiator Co., Ltd., Toronto
Empire Mfg. Co., Ltd., London

Pease Foundry Co., Ltd., Toronto
Steel & Radiation, Ltd., Toronto
Warden, King, Ltd., Montreal

FIXTURES (Store)

(See Store Fittings & Fixtures)

FLAG POLES (Steel & Iron)

Ontaro Wind, Engine & Motor Co., Toronto
Dyer Fence & Wire Co., Toronto
Meadows, Geo. B., Toronto

FLANGES (Brass & Iron)

Dominion Radiator Co., Ltd., Toronto
Empire Mfg. Co., Ltd., London
Kerr Engine Co., Ltd., Walkerville
Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

FLOORS (Asphalt)

Canadian Supply & Contracting Co., Toronto
Carey, Phillip, Co., Toronto
Reed, Geo. W., & Co., Ltd., Montreal

FLOORS (Cement)

Alsip Brick, Tile & Lumber Co., Winnipeg
Master Builders' Co., Toronto

FLOORS (Composition)

Canada Floors, Ltd., Montreal
Carey, Phillip, Co., Toronto
Composite Flooring Co., Ltd., Montreal
Electric Paint & Varnish Co., Cleveland
Lautz-Dunham Co., Toronto
Marbleoid Co., New York
Mosale Tile Co. of Zanesville, O., New York
Sanitary Floor Co., Toronto

FLOORS (Cork)

Kennedy, David E., nc., Montreal
Robinson Bros. Cork Co., Ltd., Toronto

FLOORS (Hardwood)

Batts, Limited, Toronto
Georgian Bay Shook Mills, Ltd., Midland
Lickley, H. M., Ltd., Toronto
Seaman-Kent Co., Ltd., Meaford
Shearer, Jas., Co., Ltd., Montreal
Siemon Bros., Ltd., Warton
Rutherford & So, Wm., Ltd., Montreal
Webb Lumber Co., Ltd., Toronto

FLOOR FINISH

Berry Bros., Walkerville
Electric Paint & Varnish Co., Cleveland
Glidden Varnish Co., Toronto
Imperial Varnish & Color Co., Toronto
International Varnish Co., Ltd., Toronto
Jamieson, R. C., & Co., Ltd., Montreal
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Moore, Benj., & Co., Ltd., Toronto
Patton Paint Co., Newark
Pratt & Lambert, Bridgeburg
Sanderson, Percy & Co., Ltd., Toronto
Sturgeons, Limited, Toronto

FLOOR POLISH

Bate, W. B., & Co., Toronto
Ronuk, Limited, Toronto

FLOOR PRESERVATIVES

Dominion Paint Works, Ltd., Walkerville
Electric Paint & Varnish Co., Cleveland
Glidden Varnish Co., Toronto
Jamieson, R. C., & Co., Ltd., Montreal
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Moore, Benj., Co., Ltd., Toronto
Patton Paint Co., Newark
Pratt & Lambert, Bridgeburg
R. I. W. Damp Resisting Paint Co., Toronto
Ronuk Co., Ltd., Toronto
Sanderson, Percy & Co., Ltd., Toronto

FLOORS (Reinforced Concrete)

Church, Ross & Co., Montreal

FLOORS (Reinforced Concrete)—Continued
 National Fireproofing Co. of Canada, Ltd.,
 Toronto
 Noble, Clarence W., Toronto
 O'Neil, Wm. N., Co., Vancouver
 Pedlar People, Ltd., Oshawa
 Steel & Radiation, Ltd., Toronto
 Trussed Concrete Steel Co. Canada, Ltd.,
 Walkerville

FLOORS (Rubber Tile)
 Canadian Consolidated Rubber Co., Mont-
 real

FLOOR SCRAPERS
 Black Building Supply Co., Toronto
 Hurley Machine Co., Toronto
 Weber Mfg. Co., Milwaukee

FLOORS (Tile & Mosaic)
 Alsip Brick, Tile & Lumber Co., Winnipeg
 Chance Bros. & Co., Ltd., near Birming-
 ham, Eng.
 Dominion Marble Co., Ltd., Montreal
 Gaudry, L. H., & Co., Ltd., Quebec
 Hoidge Marble Co., Ltd., Toronto
 Lautz-Dunham Co., Toronto
 Ludowici-Celadon Co., Chicago
 Missisquoi Marble Co., Ltd., Montreal
 Mosaic Tile Co. of Zanesville, O., New
 York
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Smith Marble & Construction Co., Ltd.,
 Montreal
 Waite-Fullerton Co., Ltd., Winnipeg

FLOORS (Wood Block)
 Nightingale Co., New York
 Wilson, Jas. G., Mfg. Co., New York

FOUNDATIONS
 Foundation Co., Ltd., Montreal
 MacArthur Concrete Pile & Foundation
 Co., New York

FURNACES (Gas)
 Consumers' Gas Co., Toronto

FURNACE (Hot Air)
 Clare Bros. & Co., Ltd., Preston
 Galt Stove & Furnace Co., Ltd., Galt
 Gurney Foundry Co., Toronto
 Howard Furnace Co., Toronto
 McClary Mfg. Co., London
 Moffatt Stove Co., Ltd., Weston
 Pease Foundry Co., Ltd., Toronto
 Smart, Jas., Mfg. Co., Ltd., Brockville
 Steel & Radiation Co., Ltd., Toronto
 Stewart, Jas., Mfg. Co., Ltd., Woodstock
 Taylor-Forbes Co., Ltd., Guelph
 Toronto Furnace & Crematory Co., Ltd.,
 Toronto

FURNITURE
 Berlin Interior Hardwood Co., Berlin
 Cushing Bros. Co., Ltd., Calgary
 Knight Bros. Co., Ltd., Burk's Falls
 Rhodes-Curry Co., Ltd., Amherst
 Tiffany Studios, New York

FURNITURE (Office)
 Batts, Limited, Toronto
 Berlin Interior Hardwood Co., Berlin
 Blonde Lumber & Mfg. Co., Chatham
 Canadian Ornamental Iron Co., Ltd., To-
 ronto
 Cushing Bros. Co., Ltd., Calgary
 Dennis Wire & Iron Works, London
 Dominion Marble Co., Ltd., Montreal
 Meadows, Geo. B., Toronto
 Rhodes-Curry Co., Ltd., Amherst

FURRING METAL
 Beath, W. D., & Son, Ltd., Toronto
 Church, Ross & Co., Montreal
 Hoidge & Son, Toronto
 Hynes, W. J., Toronto
 Manitoba Gypsum Co., Ltd., Winnipeg
 Noble, Clarence W., Toronto
 O'Neil, Wm. N., Co., Vancouver
 Pedlar People, Ltd., Oshawa
 Steel & Radiation, Ltd., Toronto

Trussed Concrete Steel Co. of Canada,
 Ltd., Walkerville

FURRING TERRA COTTA
 Alsip Brick, Tile & Lumber Co., Winnipeg
 Don Valley Brick Works, Toronto
 Waite-Fullerton Co., Ltd., Winnipeg

G

GALVANIZED IRON
 Aikenhead Hardware Co., Toronto
 Leslie, A. C., & Co., Ltd., Montreal

GALVANIZED PIPING
 Cluff Bros., Toronto
 Conduits Co., Ltd., Toronto
 Dominion Radiator Co., Ltd., Toronto
 Empire Mfg. Co., Ltd., London
 Ormsby, A. B., Co., Ltd., Toronto
 Pedlar People, Ltd., Oshawa
 Sheldons, Limited, Galt
 Steel & Radiation, Ltd., Toronto

GARBAGE & REFUSE BURNERS
 Decari Incinerator Co., New York
 Dominion Radiator Co., Ltd., Toronto
 Nightingale Co., New York

GAS FIXTURES & LIGHTING
 Chadwick Brass Co., Hamilton
 Consumers' Gas Co., Ltd., Toronto
 Hankin, Francis, & Co., Montreal
 Jefferson Glass Co., Ltd., Toronto
 Mitchell, Robt., Co., Ltd., Montreal
 Morrison, Jas., Brass Mfg. Co., Toronto
 Sicke Gas Co., Ltd., Toronto

GASKET RUBBER
 Canadian Consolidated Rubber Co., Mont-
 real

GASKETS
 Aikenhead Hardware Co., Toronto
 Canadian Kellogg Co., Ltd., Montreal

GAS MACHINES
 Sicke Gas Co., Ltd., Toronto

GAS METERS
 Consumers' Gas Co., Toronto
 Mitchell, Robt., Co., Ltd., Montreal
 Sicke Gas Co., Ltd., Toronto

GAS STOVES
 Consumers' Gas Co., Ltd., Toronto
 McClary Mfg. Co., London
 Mitchell, Robt., Co., Ltd., Montreal
 Sicke Gas Co., Ltd., Toronto

GATES
 Aikenhead Architectural Metal Works,
 Toronto
 Canada Wire & Iron Goods Co., Hamilton
 Canadian Ornamental Iron Co., Ltd., To-
 ronto
 Estey Bros. Co., Montreal
 Dyer Fence & Supply Co., Ltd., Toronto
 Dennis Wire & Iron Works, London
 Hankin, Francis, & Co., Montreal
 Meadows, Geo. B., Toronto
 Tiffany Studios, New York
 Yellin, Samuel, Philadelphia

GAUGES
 Aikenhead Hardware Co., Toronto
 Dominion Radiator Co., Ltd., Toronto
 Dunham, C. A., & Co., Ltd., Toronto
 Empire Mfg. Co., Ltd., London
 Mitchell, Robt., Co., Ltd., Montreal
 Morrison, Jas., Brass Mfg. Co., Ltd., To-
 ronto

GENERATORS & MOTORS (Electric)
 Canada Foundry Co., Ltd., Toronto
 Canadian General Electric Co., Toronto
 Canadian Westinghouse Co., Ltd., Toronto
 Jones & Moore Electric Co., Toronto
 National Equipment Co., Toronto
 Stuart, Drinkwater & Hingston, Montreal

GESSO (Plastering)

Dancy, R. C., Toronto
Dominion Gypsum Co., Ltd., Winnipeg
Hynes, Wm. J., Toronto

GLASS (Art)

Canada Art Glass Co., Toronto
Chance Bros. & Co., near Birmingham, Eng.
Hobbs Mfg. Co., Ltd., London
Jeffries & Co., Toronto
Sanderson, Percy & Co., Ltd., Toronto
Toronto Plate Glass Importing Co., Toronto
Dows Glass Co., Toronto

GLASS (Bent)

Chance Bros. & Co., Ltd., near Birmingham, Eng.
Consolidated Plate Glass Co., Toronto
Hobbs Mfg. Co., Ltd., London
Toronto Plate Glass Co., Toronto

GLASS (Bevelled)

Chance Bros. & Co., Ltd., Birmingham, Eng.
Consolidated Plate Glass Co., Ltd., Toronto
Hobbs Mfg. Co., Ltd., London
Toronto Plate Glass Importing Co., Toronto

GLASS (Cathedral)

Canadian Art Glass Co., Toronto
Dows Glass Co., Toronto
Hobbs Mfg. Co., Ltd., London

GLASS (Plate & Window)

Chance Bros. & Co., Ltd., near Birmingham, Eng.
Consolidated Plate Glass Co., Ltd., Toronto
Cushing Bros. Co., Ltd., Calgary
Dow's Glass Supply Co., Toronto
Hobbs Mfg. Co., Ltd., London
Montreal Plate Glass Co., Ltd., Montreal
National Plate Glass Works, Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Pilkington Bros. Ltd., Montreal
Sanderson, Percy & Co., Ltd., Toronto
Toronto Plate Glass Importing Co., Ltd., Toronto

GLASS (Prism)

Chance Bros. & Co., Ltd., near Birmingham, Eng.
Consolidated Plate Glass, Ltd., Toronto
Dartnell, Ltd., Montreal
Hobbs Mfg. Co., Ltd., London
Luxfer Prism Co., Ltd., Toronto
Pilkington Bros., Ltd., Montreal
Queen City Glass Co., Toronto

GLASS (Sheet)

Consolidated Plate Glass Co., Ltd., Toronto
Dow's Glass Supply Co., Toronto
Hobbs Mfg. Co., Ltd., London
Toronto Plate Glass & Importing Co., Toronto

GLASS (Stained or Leaded)

Canadian Art Glass Co., Toronto
Chance Bros. & Co., Ltd., near Birmingham, Eng.
Consolidated Plate Glass Co., Ltd., Toronto
Cushing Bros. Co., Ltd., Calgary
Dow's Plate Glass Supply Co., Toronto
Jeffries, The, Toronto
Hobbs Mfg. Co., Ltd., London
Luxfer Prism Co., Ltd., Toronto
Montreal Paint Glass Co., Ltd., Montreal
O'Neil, Wm. N., Co., Ltd., Vancouver
Pilkington Bros., Ltd., Montreal
Sanderson, Percy & Co., Ltd., Toronto
Tiffany Studios, New York
Toronto Plate Glass Importing Co., Ltd., Toronto

GLASS (Tile)

Dartnell, Ltd., Montreal

Dominion Marble Co., Ltd., Montreal
Hankin, Francis, & Co., Montreal
Hobbs Mfg. Co., Ltd., London
Lautz-Dunham Co., Toronto
Ludowici-Celabon Co., Chicago
Tiffany Studios, New York
Toronto Plate Glass Importing Co., Ltd., Toronto

GLASSWARE (Illuminating)

Jefferson Glass Co., Ltd., Toronto

GRANITE (Crushed)

Argenteuil Granite Co., Ltd., Montreal
Sand & Supplies, Ltd., Toronto

GRANITE (Monumental or Structural)

Argenteuil Granite Co., Ltd., Montreal
Hankin, Francis, & Co., Montreal
Holmes, Fred, & Son, Toronto
Laurentian Granite Co., Ltd., Montreal
Penn, Wm., Stone Co., Minneapolis
Smith Marble & Construction Co., Ltd., Montreal

GRATINGS (Sidewalk)

Canada Foundry Co., Ltd., Toronto
Canada Wire & Iron Goods Co., Hamilton
Estey Bros. Co., Montreal
Hobbs Mfg. Co., Ltd., London
Luxfer Prism Co., Ltd., Toronto
Meadows, Geo. B., Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver

GRAVEL

Ontario Lime Co., Ltd., Toronto
Ramsay & Kelly, Montreal
Sand & Supplies, Ltd., Toronto
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
York Sand & Gravel Co., Toronto

GRAVEL ROOFING

(See Roofing Material)

GREASE TRAPS

Cluff Bros., Toronto
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
Warden, King, Ltd., Montreal

GREENHOUSES

Lord & Burnham Co., Toronto
Pierson U-Bar Co., Montreal
Parkes Construction Co., Hamilton

GRILLES

Aikenhead Architectural Metal Works, Toronto
Canada Wire & Iron Goods Co., Hamilton
Meadows, Geo. B., Toronto
Tuttle & Bailey Mfg. Co., of Canada, Ltd., Bridgeburg

GUARDS (Door or Window)

Canada Wire & Iron Goods Co., Hamilton
Canadian Ornamental Iron Co., Ltd., Toronto
Dyer Fence & Supply Co., Toronto
Dennis Wire & Iron Works, London
Gaudry, L. H., & Co., Quebec
Meadows, Geo. B., Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Steel & Radiation, Ltd., Toronto
Windowstrip Co., Montreal

GUARDS (Iron & Wire)

Aikenhead Hardware Co., Toronto
Canada Wire & Iron Goods Co., Hamilton
Canadian Ornamental Iron Co., Ltd., Toronto
Dennis Wire & Iron Works, London
Dominion Architectural Iron Works, Ltd., Montreal
Dominion Ornamental Iron Co., Ltd., Toronto
Dyer Fence & Supply Co., Toronto
Estey Bros. Co., Montreal
Meadows, Geo. B., Toronto
Ormsby, A. B., Ltd., Toronto
Steel & Radiation, Ltd., Toronto

GUARDS (Snow)

Canada Wire & Iron Goods Co., Hamilton
 Dennis Wire & Iron Works, London
 Dominion Ornamental Iron Co., Toronto
 Duplex Hanger Co., Cleveland, O.
 Manitoba Bridge & Iron Works, Winnipeg
 Roofers' Supply Co., Ltd., Toronto

GYMNASIUM EQUIPMENT

Wilson, Harold A., Co., Ltd., Toronto

H**HAMMERED LEAF WORK (Bronze & Iron)**

Cloisonne Glass Co., Ltd., Berlin
 Estey Bros. Co., Montreal
 Tiffany Studios, New York

HANGERS (Beam, Joist & Wall)

Aikenhead Hardware Co., Toronto
 Canada Foundry Co., Ltd., Toronto
 Dennis Wire & Iron Works, London
 Dodge Mfg. Co., Ltd., Toronto
 Duplex Hanger Co., Cleveland
 Feather & Roadhouse, Toronto
 Gaudry, L. H., & Co., Ltd., Quebec
 Goldie & McCulloch, Ltd., Galt
 O'Neil Wm. N., Co., Ltd., Vancouver
 Ormsby, A. B., Ltd., Toronto
 Steel & Radiation, Toronto
 Taylor-Forbes Co., Ltd., Guelph
 Trussed Concrete Steel Co., Walkerville
 Van Dorn Iron Works Co., Cleveland

HANGERS (Door)

Aikenhead Hardware Co., Toronto
 Allith Mfg. Co., Ltd., Hamilton
 Ormsby, A. B., Co., Ltd., Toronto
 Reliance Ball-bearing Door Hanger Co.,
 New York
 Richards-Wilcox Canadian Co., Ltd., Lon-
 don
 Van Dorn Mfg. Co., Cleveland, O.

HANGERS (Shaft)

Duplex Hanger Co., Cleveland
 Goldie & McCulloch Co., Ltd., Galt
 Manitoba Bridge & Iron Works, Winnipeg
 Miller Bros. & Sons, Ltd., Montreal
 Sheldons, Ltd., Galt
 Watrous Engine Works Co., Ltd., Brant-
 ford

HARDWARE (Builders')

Aikenhead Hardware Co., Toronto
 Allith Mfg. Co., Ltd., Hamilton
 Alza Co., Ltd., Montreal
 Belleville Hardware & Lock Mfg. Co.,
 Ltd., Belleville
 Canada Hardware, Ltd., Toronto
 Cowan & Britton, Ltd., Gananoque
 Lariviere, Inc., Montreal
 Richards-Wilcox Mfg. Co., London
 Russell Hardware Co., Toronto
 Soss Invisible Hinge Co., Toronto
 Stinson-Reeb Builders' Supply Co., Ltd.,
 Montreal
 Taylor-Forbes Co., Ltd., Guelph
 Vokes Hardware Co., Toronto
 Vokes, Jas. L., & Son, Toronto
 Walker, Jas., Hardware Co., Ltd., Mont-
 real
 Walker, W., & Sons, Toronto
 Yale & Towne, Ltd., St. Catharines

HARDWARE FITTINGS

Batts, Ltd., Toronto
 Berlin Interior Hardwood Co., Ltd., Berlin
 Blonde Lumber & Mfg. Co., Chatham
 Burton & Baldwin Mfg. Co., Ltd., Hamil-
 ton
 Canada Lumber Co., Ltd., Toronto
 Cushing Bros. & Co., Ltd., Calgary
 Green Bros., Toronto
 Knight Bros. & Co., Ltd., Burk's Falls
 Lickley, H. M., Ltd., Toronto
 O'Neil, Wm. N., & Co., Ltd., Vancouver
 Rhodes-Curry Co., Ltd., Amherst
 Rutherford, Wm., & Son, Ltd., Montreal
 Webb Lumber Co., Ltd., Toronto

HARDWOOD FLOORS

(See Floors, Hardwood)

HEATERS (Car)

Canadian H. W. Johns-Manville Co., Ltd.,
 Toronto
 Canadian Rector Gas Heating Co., Ltd.,
 Hamilton
 Pease Foundry Co., Ltd., Toronto
 Warden, King, Ltd., Montreal

HEATERS (Gas, Water)

Canadian Rector Gas Heating Co., Ltd.,
 Hamilton
 Cluff Bros., Toronto
 Consumers' Gas Co., Ltd., Toronto
 Empire Mfg. Co., Ltd., London
 McClary Mfg. Co., London
 Peerless Heater Co., Ltd., Montreal
 Pittsburgh Water Heater Co., Toronto
 Polson Iron Works, Ltd., Toronto
 Rudd Mfg. Co., Toronto

HEADLIGHTS (Arc & Inc, Electric)

Crouse-Hinds Co., Ltd., Toronto

HEATERS (Tank)

Canadian Rector Gas Heating Co., Ltd.,
 Hamilton
 Cluff Bros., Toronto
 Consumers' Gas Co., Toronto
 Dominion Radiator, Ltd., Toronto
 Goldie & McCulloch Co., Ltd., Galt
 Pease Foundry Co., Ltd., Toronto
 Polson Iron Works, Ltd., Toronto
 Steel & Radiation, Ltd., Toronto

HEATERS (Water)

Canadian Rector Gas Heating Co., Ltd.,
 Hamilton
 Cluff Bros., Toronto
 Dominion Radiator Co., Ltd., Toronto
 McClary Mfg. Co., London
 Pease Foundry Co., Ltd., Toronto

HEATING APPLIANCES

Canada Foundry Co., Ltd., Toronto
 Canadian Fairbanks-Morse Co., Ltd.,
 Montreal
 Canadian Powers Regulator Co., Ltd., To-
 ronto
 Canadian Rector Gas Heating Co., Ltd.,
 Hamilton
 Dominion Radiator Co., Ltd., Toronto
 Laurie & Lambe, Montreal
 McClary Mfg. Co., London
 Pease Foundry Co., Ltd., Toronto
 Sheldons, Ltd., Galt
 Steel & Radiation, Ltd., Toronto
 Stewart, Jas., Mfg. Co., Woodstock
 Warden, King, Ltd., Montreal

HEATING SUPPLIES

Canadian Buffalo Forge Co., Ltd., Mont-
 real
 Canadian Fairbanks-Morse Co., Ltd.,
 Montreal
 Canadian Rector Gas Heating Co., Ltd.,
 Hamilton
 Clare Bros. & Co., Ltd., Preston
 Dominion Radiator Co., Ltd., Toronto
 Empire Mfg. Co., Ltd., London
 Keiths, Ltd., Toronto
 Kerr Engine Co., Ltd., Walkerville
 Mitchell, Robt., Co., Ltd., Montreal
 Parkes Construction Co., Hamilton
 Pease Foundry Co., Ltd., Toronto
 Sheldons, Ltd., Galt
 Steel & Radiation, Ltd., Toronto
 Stewart, Jas., Mfg. Co., Ltd., Woodstock
 Warden, King, Ltd., Montreal

HEATING SYSTEMS

Canadian Rector Gas Heating Co., Ltd.,
 Hamilton
 Darling Bros., Montreal
 Dunham, C. A., Co., Ltd., Toronto
 Gardner & Gaskill, Montreal
 Garth Co., Montreal
 Illinois Engineering Co., Toronto
 Johnson Temperature Regulating Co. of
 Canada, Ltd., Toronto
 Robertson, Thos., & Co., Ltd., Montreal

HEATING SYSTEMS (Vacuum)

Canadian Rector Gas Heating Co., Ltd.,
Hamilton
Darling Bros., Montreal
Dunham, C. A., & Co., Toronto
Sturtevant, B. F., & Co., Montreal

HEAT REGULATION

Canadian Powers Regulator Co., Ltd., To-
ronto
Canadian Rector Gas Heating Co., Ltd.,
Hamilton
Dunham, C. A., Co., Toronto
Johnson Temperature Regulating Co. of
Canada, Ltd., Toronto

HINGES (Invisible)

Aikenhead Hardware Co., Toronto
Soss Invisible Hinge Co., Toronto

HOISTING APPARATUS

Aikenhead Hardware Co., Toronto
Beath, W. D., & Sons, Ltd., Toronto
Goldie & McCulloch Co., Ltd., Galt
Goold, Shapley & Muir Co., Ltd., Brant-
ford
Hankin, Francis, & Co., Montreal
Manitoba Bridge & Iron Works Ltd.,
Winnipeg
Miller Bros. & Sons, Montreal
Otis-Fensom Elevator Co., Ltd., Toronto
Richards-Wilcox Mfg. Co., London
Taylor Portable Steel Derrick Co., To-
ronto
Turnbull Elevator Mfg. Co., Toronto
Wettlaufer Bros., Toronto
Waterous Engine Works Co., Ltd., Brant-
ford

HOISTS (Contractors')

Beatty, M. & Sons, Ltd., Welland
Goldie & McCulloch Co., Ltd., Galt
Hankin, Francis, & Co., Montreal
Jeffrey Mfg. Co., Montreal
Otis-Fensom Elevator Co., Ltd., Toronto
Peacock Bros., Ltd., Montreal
Roelofson Elevator Works, Galt
Sedgwick Machine Works, Poughkeepsie
Taylor Portable Steel Derrick Co., To-
ronto
Waterous Engine Works, Ltd., Brantford
Wettlaufer Bros., Toronto

HOLLOW BUILDING BLOCKS

Alabastine Co., Ltd., Paris
Crown Gypsum Co., Ltd., Lythamore
Dominion Gypsum Co., Ltd., Winnipeg
Manitoba Gypsum Co., Ltd., Winnipeg
United States Gypsum Co., Chicago
Waite-Fullerton Co., Ltd., Winnipeg

HOPPER CLOSETS

B. O. T. Mfg. Co., Ltd., Toronto
Empire Mfg. Co., Ltd., London
Morrison, Jas., Brass Mfg. Co., Toronto
Standard Ideal Co., Ltd., Port Hope
Standard Sanitary Co., Toronto
Warden, King, Ltd., Montreal

HOPPER CLOSETS (Porcelain Enamelled)

Cluff Bros., Toronto

HOSE RACKS

Canadian Consolidated Rubber Co., Mont-
real
Empire Mfg. Co., Ltd., London
Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto

HOSE (Water or Steam, Rubber)

Canadian H. W. Johns-Manville Co., Ltd.,
Toronto
Consolidated Rubber Co., Montreal

HOSPITAL PLUMBING APPARATUS

B. O. T. Mfg. Co., Ltd., Toronto
Cluff Bros., Toronto
Empire Mfg. Co., London
Morrison Jas., Brass Mfg. Co., Ltd., To-
ronto
Standard Ideal Co., Ltd., Port Hope
Standard Sanitary Co., Ltd., Toronto

HOTEL FITTINGS

Batts, Ltd., Toronto
Berlin Interior Hardwood Co., Ltd., Berlin
Blonde Lumber & Mfg. Co., Ltd., Chatham
Burton & Baldwin Mfg. Co., Ltd., Hamil-
ton
Cushing Bros., Co., Ltd., Calgary
Green Bros., Toronto
Lickley, H. M., Ltd., Toronto
Rhodes-Curry Co., Ltd., Amherst, N.S.
Rutherford, Wm., & Son, Ltd., Montreal
Tiffany Studios, New York
Walker Bin & Store Fixture Co., Ltd.,
Berlin
Webb Lumber Co., Ltd., Toronto

HOTEL SUPPLIES

Brodeur & Co., Ltd., Montreal
Sparrows, Geo., & Co., Ltd., Toronto

HUMIDIFIERS

Canadian Powers Regulator Co., Ltd., To-
ronto
Johnson Temperature Regulating Co. of
Canada, Ltd., Toronto
Sheldons, Ltd., Galt

HYDRANTS

Canada Foundry Co., Ltd., Toronto
Cluff Bros., Toronto
Empire Mfg. Co., Ltd., London
Gaudry, L. H., & Co., Ltd., Quebec
Kerr Engine Co., Ltd., Walkerville
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto

I

ILLUMINATING GLASSWARE

Jefferson Glass Co., Ltd., Toronto

INDICATORS (Steam & Speed)

Aikenhead Hardware Co., Toronto
Canadian Fairbanks-Morse Co., Ltd.,
Montreal

INLAYING (Woodwork)

Batts, Ltd., Toronto
Burton & Baldwin Mfg. Co., Ltd., Hamil-
ton
Elliott & Son, Ltd., Toronto
Green Bros., Toronto
Lickley, H. M., Ltd., Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Rutherford & Son, Wm., Montreal
Tiffany Studios, New York
Webb Lumber Co., Ltd., Toronto

INSULATED WIRE

Canada Foundry Co., Ltd., Toronto
Canada Wire & Iron Goods Co., Hamilton
Imperial Wire & Cable Co., Ltd., Montreal
Northern Electric & Mfg. Co., Ltd., Mont-
real

INSULATING COMPOUNDS & VARNISHES

Carey, Phillip Co., Toronto
Electric Paint & Varnish Co., Cleveland
Glidden Varnish Co., Toronto
Imperial Wire & Cable Co., Ltd., Toronto
International Varnish Co., Ltd., Toronto
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Pinchin, Johnson & Co. (Canada), Ltd.,
Toronto
R. I. W. Damp Resisting Paint Co., To-
ronto
Sanderson, Percy & Co., Ltd., Toronto

INSULATORS, ELECTRIC (Composition & Porcelain)

Crouse-Hinds Co., Ltd., Toronto

INSULATION

Bird, F. W., & Son, Hamilton
Cabot, Samuel, Inc., Boston, Mass.
Canadian H. W. Johns-Manville Co., To-
ronto
Carey, Phillip Co., Toronto
Imperial Wire & Cable Co., Toronto
Robinson Bros. Cork Co., Ltd., Toronto

INSULATION (Cold Storage)

Bird, F. W., & Sons, East Walpole, Mass.
 Canadian H. W. Johns-Manville Co., Ltd.,
 Toronto
 Eureka Mineral Wool & Asbestos Co., To-
 ronto
 Kennedy, David E., Inc., Montreal
 Morrison & Dagnall, Montreal
 Robinson Bros. Cork Co., Ltd., Toronto

INTERIOR WOODWORK

Batts Ltd., Toronto
 Berlin Interior Hardwood Co., Ltd., Berlin
 Bryan Bros., Ltd., Collingwood
 Canada Lumber Co., Toronto
 Castle & Son, Montreal
 Cushing Bros. Co., Ltd., Calgary
 Eaton, J. R., & Sons, Ltd., Orillia
 Georgian Bay Shook Mills Co., Midland
 Knight Bros. & Co., Burk's Falls
 Lickley, H. M., Ltd., Toronto
 Mitchell, Robt., Co., Montreal
 Oshawa Interior Fittings Co., Oshawa
 Powell Lumber Door Mfg. Co., Toronto
 Rutherford, Wm., & Son, Ltd., Montreal
 Webb Lumber Co., Toronto
 Wilson Bros. & Co., Collingwood

IRON DOORS

Canada Foundry Co., Ltd., Toronto
 Canada Wire & Iron Goods Co., Hamilton
 Canadian Ornamental Iron Co., Ltd., To-
 ronto
 Dennis Wire & Iron Works, Ltd., London
 Dominion Architectural Iron Works, Ltd.,
 Montreal
 Dominion Ornamental Iron Co., Ltd., To-
 ronto
 Estey Bros. Co., Montreal
 Gaudry, L. H., Co., Ltd., Quebec
 Kinnear Mfg. Co., Columbus, Ohio
 Meadows, Geo. B., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Ormsby, A. M., Co., Ltd., Toronto
 Watson, Jno., & Sons of Montreal, Ltd.,
 Montreal
 Wilson, Jas. G., Mfg. Co., New York

IRON WORK (Architectural or Ornamental)

Architectural Bronze & Iron Works, To-
 ronto
 Canada Wire & Iron Goods Co., Hamilton
 Canadian Architectural Iron Works, Ltd.,
 Montreal
 Canadian Ornamental Iron Works, To-
 ronto
 Dennis Wire & Iron Works, London
 Dominion Architectural Iron Works, Ltd.,
 Montreal
 Dominion Ornamental Iron Co., Ltd., To-
 ronto
 Estey Bros. Co., Montreal
 Gaudry, L. H., & Co., Ltd., Quebec
 Manitoba Bridge & Iron Works, Ltd.,
 Winnipeg
 Meadows, Geo. B., Toronto
 Mitchell, Robt., Co., Ltd., Montreal
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Parkes Construction Co., Hamilton
 Shipway Iron Bell & Wire Mfg. Co., To-
 ronto
 Tiffany Studios, New York
 Turnbull Elevator Mfg. Co., Toronto
 Van Dorn Iron Works Co., Cleveland
 Waite-Fullerton & Co., Ltd., Winnipeg
 Watson, Jno., & Son, of Montreal, Ltd.,
 Montreal
 Yellin, Samuel, Philadelphia

IRON & STEEL BARS & SHEETS

Canada Steel Co., Ltd., Hamilton
 Canadian British Engineering Co., To-
 ronto
 Canadian Fairbanks-Morse Co., Ltd.,
 Montreal
 Canadian Ornamental Iron Co., Ltd., To-
 ronto
 Dennis Wire & Iron Works, London
 Dominion Iron & Steel Co., Ltd., Montreal
 Dyer Fence & Supply Co., Toronto
 Gaudry, L. H., & Co., Ltd., Quebec
 Goldie & McCulloch Co., Galt

Leslie, A. C., & Co., Ltd., Montreal
 Lysought, John, Ltd., Montreal
 Manitoba Bridge & Iron Co., Ltd., Win-
 niipeg
 Meadows, Geo. B., Toronto
 Ormsby, A. B., Co., Ltd., Toronto
 Pedlar People, Ltd., Oshawa
 Polson Iron Works Co., Ltd., Toronto
 Roofers' Supply Co., Ltd., Toronto
 Sheldons, Ltd., Galt
 Sicke Gas Co., Ltd., Toronto
 Steel & Radiation, Ltd., Toronto
 Steel Co. of Canada, Hamilton
 Structural Steel Co., Ltd., Montreal
 Tiffany Studios, New York

IRON FENCING

(See Fencing, Iron & Wire)

IRON FITTINGS (Malleable, Cast)

Cluff Bros., Toronto
 Dominion Radiator Co., Ltd., Toronto
 Empire Mfg. Co., Ltd., London
 Steel & Radiation, Ltd., Toronto

J**JAIL CELLS & GATES**

Ahern Safe Co., Ltd., Montreal
 Canada Wire & Iron Goods Co., Hamilton
 Canadian Ornamental Iron Co., Ltd., To-
 ronto
 Dennis Wire & Iron Works, London
 Gaudry, L. H., & Co., Ltd., Quebec
 Goldie & McCulloch Co., Ltd., Galt
 Manitoba Bridge & Iron Works, Winnipeg
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Taylor, J. & J., Co., Toronto
 Van Dorn Iron Works Co., Cleveland

K**KILNS**

Berg Machinery Mfg. Co., Toronto
 Canadian Sirocco Co., Windsor
 Sheldons, Ltd., Galt
 Sturtevant, B. L., Co. of Canada, Ltd.,
 Montreal

L**LADDERS**

Sanderson, Percy & Co., Ltd., Toronto

LADDERS (Rolling Store)

Aikenhead Hardware Co., Toronto
 Allith Mfg. Co., Ltd., Toronto
 Richards-Wilcox Mfg. Co., London

LAMP STANDARDS

Architectural Bronze & Iron Works, Ltd.,
 Toronto
 Canadian Allis-Chalmers, Ltd., Toronto
 Canadian Ornamental Iron Co., Ltd., To-
 ronto
 Dennis Wire & Iron Works, London
 Estey Bros. Co., Montreal
 Gaudry, L. H., & Co., Ltd., Quebec
 Meadows, Geo. B., Toronto
 Mitchell, Robt., Co., Ltd., Montreal
 Snead & Co., Iron Works, Ltd., Toronto

LATH (Metal)

Aikenhead Hardware Co., Toronto
 Alsip Brick, Tile & Lumber Co., Winnipeg
 Beath, W. D., & Son, Ltd., Toronto
 Braid & McCurdy, Winnipeg
 Church, Ross & Co., Montreal
 Galt Art Metal Co., Galt
 Gaudry, L. H., & Co., Ltd., Quebec
 Greening, B., wire Co., Ltd., Hamilton
 Manitoba Gypsum Co., Ltd., Winnipeg
 Morrison, Jas., Brass Mfg. Co., Ltd., To-
 ronto
 Noble, Clarence W., Toronto
 O'Neil, Wm. N., Co., Vancouver
 Ormsby, A. B., Co., Toronto
 Pedlar People, Oshawa
 Steel & Radiation, Ltd., Toronto
 Stinson-Reeb Builders' Supply Co., Mont-
 real
 Trussed Concrete Steel Co., Walkerville

LATH (Wood)

Batts, Ltd., Toronto
 Canada Lumber Co., Ltd., Toronto
 Knight Bros. Co., Ltd., Burk's Falls
Rutherford, Wm., & Son, Ltd., Montreal
Shearer, Jas., & Co., Ltd., Montreal
Webb Lumber Co., Ltd., Toronto

LAUNDRY EQUIPMENT

American Laundry Machinery Co., Toronto
Cluff Bros., Toronto
 Empire Mfg. Co., Ltd., London
 Meyer Bros., Toronto
Morrison, Jas., Brass Mfg. Co., Toronto
 Toronto Laundry Machinery Co., Toronto
 Warden, King, Ltd., Montreal

LAVATORIES

B. O. T. Mfg. Co., Ltd., Toronto
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
Chance Bros. & Co., Ltd., near Birmingham, Eng.
Cluff Bros., Toronto
 Empire Mfg. Co., Ltd., London
 Missisquoi-Lautz Corp'n, Montreal
Morrison, Jas., Brass Mfg. Co., Toronto
Smith Marble & Construction Co., Montreal
 Warden, King, Ltd., Montreal

LEAD (Red & White)

Aikenhead Hardware Co., Toronto
 Glidden Varnish Co., Toronto
Jamieson, R. C., & Co., Ltd., Montreal
Lowe Bros., Ltd., Toronto
 Martin-Senour Co., Ltd., Montreal
Moore, Benj., & Co., Ltd., Toronto
 Patton Paint Co., New York
Sanderson, Percy & Co., Ltd., Toronto
 Sturgeons, Ltd., Toronto

LIGHTING FIXTURES

Chadwick Brass Co., Ltd., Hamilton
 Hankin, Francis, & Co., Montreal
 Jefferson Glass Co., Ltd., Toronto
 Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Toronto
 Northern Electric & Mfg. Co., Ltd., Montreal
 Tiffany Studios, New York

LIME

Braid & McCurdy, Winnipeg
 Crown Gypsum Co., Lythmore
 Manitoba Gypsum Co., Ltd., Winnipeg
 Ontario Lime Co., Ltd., Toronto
Sand & Supplies, Ltd., Toronto
Stinson-Reeb Builders' Supply Co., Ltd., Montreal

LOCKERS (Metal)

Canada Wire & Iron Goods Co., Hamilton
Canadian Ornamental Iron Co., Ltd., Toronto
Dennis Wire & Iron Works, London
 Dominion Architectural Iron Works, Ltd., Montreal
Meadows, Geo. B., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Ormsby, A. B., Co., Ltd., Toronto
 Pedlar People, Ltd., Oshawa
 Steel & Radiation, Toronto

LOCKERS (Sanitary Steel)

Canadian Ornamental Iron Co., Toronto
Dennis Wire & Iron Co., London
Canada Wire & Iron Goods Co., Hamilton
Meadows, Geo. B., Toronto

LOCKS

Aikenhead Hardware Co., Toronto
 Canada Hardware, Ltd., Toronto
Goldie & McCulloch Co., Galt
 Russill Hardware Co., Toronto

LOCKS (Elevator Door)

Reliance Ball Bearing Door Hanging Co., New York
 Watson, Jno., & Son, of Montreal, Ltd., Montreal

LUMBER

Alsip Brick, Tile & Lumber Co., Winnipeg
Batts, Ltd., Toronto
 Blonde Lumber & Mfg. Co., Chatham
 Canada Lumber Co., Ltd., Toronto
 Cushing Bros. Co., Ltd., Calgary
 Knight Bros. Co., Ltd., Burk's Falls, Ont.
 Laidlaw, R., Co., Ltd., Toronto
Lickley, H. M., Ltd., Toronto
 Rhodes Curry Co., Ltd., Amherst
Shearer, Jas., & Co., Ltd., Montreal
 Siemon Bros., Ltd., Warton
Webb Lumber Co., Ltd., Toronto

M

MACHINERY (Transmission)

Berg Machinery Co., Ltd., Toronto
Goldie & McCulloch Co., Ltd., Galt
Miller Bros. & Sons, Ltd., Montreal

MAIL CHUTES

(See Chutes, Mail)

MANHOLE COVERS & FRAMES

Architectural Bronze & Iron Works, Toronto
Canadian Ornamental Iron Co., Toronto
 Clare Bros. & Co., Ltd., Preston
 Dominion Ornamental Iron Co., Ltd., Toronto
 Gaudry, L. H., & Co., Ltd., Quebec
 Kerr Engine Co., Ltd., Walkerville

MANTELS

Batts, Ltd., Toronto
 Berlin Interior Hardwood Co., Ltd., Berlin
 Canada Lumber Co., Ltd., Toronto
 Cushing Bros. Co., Ltd., Calgary
 Knight Bros. Co., Ltd., Burk's Falls
Rutherford & Son, Montreal

MANTELS (Brick)

Alsip Brick, Tile & Lumber Co., Winnipeg
 Don Valley Brick Works, Toronto
Milton Brick Co., Milton

MARBLE (Artificial)

Dancy, R. C., Toronto
 Hankin, Francis & Co., Montreal
 Hoidge Marble Co., Toronto
 Italian Mosaic & Tile Co., Toronto
Lautz-Dunham & Co., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver

MARBLE (Structural or Monumental)

Dartnell, E. F., Montreal
 Dominion Marble Co., Ltd., Montreal
 Hankin, Francis, & Co., Montreal
 Hoidge Marble Co., Toronto
Lautz-Dunham & Co., Toronto
 Missisquoi Marble Co., Ltd., Montreal
 Robertson, Jas. B., Co., Montreal
Smith Marble & Construction Co., Montreal

MARBLE WORK

Canadian Marble Co., Toronto
 Dominion Marble Co., Ltd., Montreal
 Gibson, J. G., Marble & Granite Co., Toronto
 Hoidge Marble Co., Toronto
Lautz-Dunham & Co., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Ontario Marble Quarries, Ltd., Toronto
Smith Marble & Construction Co., Ltd., Montreal

MARQUISES (Iron & Bronze)

Aikenhead Architectural Metal Works, Toronto
Canadian Ornamental Iron Co., Ltd., Toronto
Dennis Wire & Iron Works, Ltd., London
Estey Bros. Co., Montreal
 Luxfer Prism Co., Ltd., Toronto
Meadows, Geo. B., Toronto
 Mitchell, Robt., Co., Ltd., Montreal
Yellin, Samuel, Philadelphia

MEMORIAL TABLETS (Brass or Bronze)
 Booth, Geo., & Son, Toronto
 Estey Bros., Montreal
 Richardson, J. E., & Co., Toronto

MEMORIAL WINDOWS
 Canadian Art Glass Co., Toronto
 Hobbs Mfg. Co., Ltd., London
 Jeffries, The, Toronto
 National Plate Glass Co., Toronto

METAL CEILINGS
 Beath, W. D., & Son, Ltd., Toronto
 Noble, Clarence W., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Pedlar People, Ltd., Oshawa

METAL FURNITURE
 Dennis Wire & Iron Works, London
 Office Specialty Co., Toronto
 Snead & Co., Iron Works, Ltd., Toronto

METAL ROOFING
 (See Roofing, Metal)

METAL SIDING
 Beath, W. D., & Son, Ltd., Toronto
 Noble, Clarence W., Toronto
 Ormsby, A. B., Co., Ltd., Toronto
 Pedlar People, Ltd., Oshawa

METAL STUDDING
 (See Studding, Metal)

METAL WEATHER STRIPS
 (See Weather Strips)

METAL WORK
 Ahern Safe Co., Ltd., Montreal
 Canada Wire & Iron Goods Co., Hamilton
 Canadian Ornamental Iron Co., Ltd., Toronto
 Dennis Wire & Iron Works, London
 Meadows, Geo. B., Toronto
 Mitchell, Robt., Ltd., Montreal
 Taylor, J. & J., Ltd., Toronto
 Tiffany Studios, New York
 Turnbull Elevator Mfg. Co., Toronto
 Window Strip Co., Montreal

METAL WORK (Iron or Steel, Structural)
 Bains & Peckover, Toronto
 Canada Steel Co., Hamilton
 Canadian Bridge Co., Ltd., Walkerville
 Eastern Canada Steel & Iron Works, Ltd., Quebec
 Gaudry, L. H., & Co., Ltd., Quebec
 Hamilton Bridge Works Co., Hamilton
 Harker & Kembly, Toronto
 Leslie, A. C., & Co., Ltd., Montreal
 Manitoba Bridge & Iron Works, Ltd., Winnipeg
 McGregor & McIntyre, Toronto
 Mussels, Ltd., Montreal
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Phoenix Bridge & Iron Works, Montreal
 Polson Iron Works, Ltd., Toronto
 Reid & Brown, Toronto
 Sarnia Bridge Co., Sarnia
 Sheldons, Ltd., Galt
 Steel Co. of Canada, Hamilton
 Toronto Iron Foundry Co., Toronto
 Toronto Structural Steel Co., Toronto
 Structural Steel Co., Ltd., Montreal

MILL MACHINERY
 Berg Machinery Mfg. Co., Ltd., Toronto
 Canadian Fairbanks-Morse Co., Ltd., Montreal
 Goldie & McCulloch Co., Ltd., Galt
 Miller Bros. & Sons, Montreal
 Waterous Engine Works Co., Ltd., Brantford

MINERAL WOOL
 Eureka Mineral Wool & Asbestos Co., Toronto

MIRRORS
 Aikenhead Hardware Co., Toronto
 Consolidated Plate Glass Co., Ltd., Toronto

Cushing Bros. Co., Ltd., Calgary
 Dow's Glass Supply Co., Toronto
 Hobbs Mfg. Co., Ltd., London
 Montreal Paint & Glass Co., Montreal
 National Plate Glass & Mirror Works, Toronto
 Pilkington Bros., Ltd., Montreal
 Sanderson, Percy & Co., Ltd., Toronto
 Toronto Plate Glass Importing Co., Ltd., Toronto

MODELLING (Plaster)
 Canadian Art Stone Co., Ltd., Toronto
 Dancy, R. C., Toronto
 Dominion Gypsum Co., Ltd., Winnipeg
 Hoidge & Sons, Toronto
 Hynes, Wm. J., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Stinson-Reeb Builders' Supply Co., Ltd., Montreal

MOULDINGS (Metal)
 Canadian Store Front Co., Hamilton
 Easyset Store Front Co., Ltd., Toronto
 Kawneer Mfg. Co., Toronto
 Ormsby, A. B., Co., Ltd., Toronto

MOULDINGS (Wood)
 Batts, Ltd., Toronto
 Blonde Lumber Mfg. Co., Chatham
 Canada Lumber Co., Ltd., Toronto
 Cushing Bros. Co., Ltd., Calgary
 Knight Bros. Co., Ltd., Burk's Falls, Ont.
 Lickley, H. M., Ltd., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Rhodes-Curry Co., Ltd., Amherst
 Rutherford, Wm., & Sons Co., Ltd., Montreal
 Webb Lumber Co., Ltd., Toronto

N

NAILS
 Aikenhead Hardware Co., Toronto
 Cowan & Britton, Ltd., Gananoque
 Russill Hardware Co., Toronto

NAME PLATES (Brass & Bronze)
 Booth, G., & Son, Toronto
 Estey Bros. & Co., Montreal
 Richardson, J. E., & Co., Toronto

NOZZLES (Hose & Spray)
 Aikenhead Hardware Co., Toronto
 Canadian Fairbanks-Morse Co., Ltd., Montreal
 Mitchell, Robt., Co., Ltd., Montreal
 Morrison, Jas., Brass Mfg. Co., Toronto
 Warden, King, Ltd., Montreal
 Waterous Engine Works Co., Ltd., Brantford

O

OFFICE FURNISHINGS
 Batts, Ltd., Toronto
 Berlin Interior Hardwood Co., Ltd., Berlin
 Cushing Bros. Co., Ltd., Calgary
 Dominion Marble Co., Ltd., Montreal
 Lickley, H. M., Ltd., Toronto
 Rhodes-Curry Co., Ltd., Amherst
 Rutherford, Wm., & Son, Ltd., Montreal
 Webb Lumber Co., Ltd., Toronto

OIL COLORS
 Berry Bros., Walkerville
 Glidden Varnish Co., Toronto
 International Varnish Co., Ltd., Toronto
 Lowe Bros., Ltd., Toronto
 Martin-Senour Co., Ltd., Montreal
 Moore, Benj., & Co., Ltd., Toronto
 Sanderson & Percy, Toronto
 Sturgeons, Ltd., Toronto

OIL PUMPS
 (See Pumps, Oil)

OPALINE
 Hobbs Mfg. Co., Ltd., London

OPERA HOUSE SEATS

Berlin Interior Hardwood Co., Ltd., Berlin
Canadian Office & School Furniture Co.,
Ltd., Preston
Globe Furniture Co., Ltd., Waterloo

P

PACKING (Sheets)

Canadian H. W. Johns-Manville Co., Ltd.,
Toronto
Consolidated Rubber Co., Ltd., Montreal
Garlock Packing Co., Hamilton
Jenkins Bros., Ltd., Montreal
Quaker City Rubber Co., Philadelphia

PAINTS (Decorative)

Bate, W. B., & Co., Toronto
Berry Bros., Ltd., Walkerville
Harland, Wm., & Co., Ltd., Toronto
Glidden Varnish Co., Toronto
**Imperial Varnish & Color Co., Ltd., To-
ronto**
International Varnish Co., Ltd., Toronto
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Moore, Benj., & Co., Ltd., Toronto
Sanderson & Pearcey, Toronto

PAINTS

Aikenhead Hardware Co., Toronto
Alabastine Co., Paris, Ont.
Ault & Wiborg Co., Toronto
Bate, W. B., & Co., Toronto
Berry Bros., Walkerville
Brandram-Henderson Co., Montreal
Canadian Oil Co., Toronto
Dods, P. D., & Co., Ltd., Montreal
Dominion Paint Works, Ltd., Walkerville
Dougall Varnish Co., Ltd., Montreal
Electric Paint & Varnish Co., Cleveland
Glidden Varnish Co., Toronto
Harland, Wm., & Son, Toronto
Holland Varnish Co., Montreal
Imperial Varnish & Color Co., Toronto
International Varnish Co., Ltd., Toronto
Jamieson, R. C., & Co., Ltd., Montreal
Langmuir, Jas., & Co., Ltd., Toronto
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Montreal Paint & Glass Co., Montreal
Moore, Benj., Co., Ltd., Toronto
Patton Paint Co., Newark
Pinchin, Johnson & Co., Canada, Ltd.,
Toronto
**R. I. W. Damp Resisting Paint Co., To-
ronto**
Russill Hardware Co., Toronto
Sanderson, Pearcey Co., Toronto
Sturgeons, Ltd., Toronto

PAINTS (Aluminum)

**Imperial Varnish & Color Co., Ltd., To-
ronto**
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Sturgeons, Ltd., Toronto

PAINTS (Calorie)

Electric Paint & Varnish Co., Cleveland

PAINTS (Cement, Concrete, Waterproofing)

Aikenhead Hardware Co., Toronto
Ault & Wiborg Co., Ltd., Toronto
Alderson, Hammond & Ritchey, Ltd., To-
ronto
Berry Bros., Ltd., Walkerville
Canadian Supply & Contracting Co., To-
ronto
Dartnell, E. F., Ltd., Montreal
Dominion Paint Works, Ltd., Walkerville
Electric Paint & Varnish Co., Cleveland
Harland, Wm., & Son, Toronto
Hercules Waterproofing Co., Buffalo, N.Y.
Glidden Varnish Co., Toronto
Jamieson, R. C., & Co., Ltd., Montreal
Lowe Bros., Ltd., Toronto
Moore, Benj., Co., Ltd., Toronto
Pratt & Lambert, Bridgeburg
**R. I. W. Damp Resisting Paint Co., To-
ronto**

Sanderson, Pearcey & Co., Ltd., Toronto

**Trussed Concrete Steel Co., Ltd., Walk-
erville**

• **Walkerville Hardware Co., Ltd., Walk-
erville**

PAINTS (Interior & Exterior)

Berry Bros., Ltd., Walkerville
Dominion Paint Works, Ltd., Walkerville
Electric Paint & Varnish Co., Cleveland
Harland, Wm., & Co., Ltd., Toronto
Glidden Varnish Co., Toronto
**Imperial Varnish & Color Co., Ltd., To-
ronto**
International Varnish Co., Ltd., Toronto
Jamieson, R. C., & Co., Ltd., Montreal
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Montreal Paint & Glass Co., Ltd., Mont-
real
Moore, Benj., & Co., Ltd., Toronto
Patton Paint Co., Newark
Pinchin, Johnson & Co., Canada, Ltd., To-
ronto
**R. I. W. Damp Resisting Paint Co., To-
ronto**
Sanderson, Pearcey & Co., Ltd., Toronto
Sturgeons, Ltd., Toronto
**Trussed Concrete Steel Co., Canada, Ltd.,
Walkerville**

PAINTS (Floor)

Bate, W. B., & Co., Toronto
Berry Bros., Ltd., Walkerville
Dominion Paint Works, Ltd., Walkerville
Electric Paint & Varnish Co., Cleveland
Glidden Varnish Co., Toronto
**Imperial Varnish & Color Co., Ltd., To-
ronto**
International Varnish Co., Toronto
Jamieson, R. C., & Co., Ltd., Montreal
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Master Paint & Glass Co., Ltd., Montreal
Moore, Benj., & Co., Ltd., Toronto
Patton Paint Co., Newark
Pinchin, Johnson & Co. (Canada), Ltd.,
Toronto
**R. I. W. Damp Resisting Paint Co., To-
ronto**
Sanderson, Pearcey & Co., Ltd., Toronto
Sturgeons, Ltd., Toronto

PAINTS (Gold)

**Imperial Varnish & Color Co., Ltd., To-
ronto**
International Varnish Co., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Sturgeons, Ltd., Toronto

PAINTS (Graphite)

Dominion Paint Works, Ltd., Walkerville
Electric Paint & Varnish Co., Cleveland
**Imperial Varnish & Color Co., Ltd., To-
ronto**
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Sturgeons, Ltd., Toronto

PAINTS (Iron & Steel)

Alderson, Hammond & Ritchey, Ltd., To-
ronto
Brandram-Henderson Co., Montreal
Carey, Phillip, Co., Toronto
Dartnell, E. F., Ltd., Montreal
Dominion Paint Works, Walkerville
Electric Paint & Varnish Co., Cleveland
Harland, Wm., & Son, Toronto
Glidden Varnish Co., Toronto
Imperial Varnish & Color Co., Toronto
International Varnish Co., Toronto
Jamieson, R. C., & Co., Ltd., Montreal
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Montreal Paint & Glass Co., Montreal
Moore, Benj., & Co., Ltd., Toronto
Ottawa Paint Co., Ottawa
**R. I. W. Damp Resisting Paint Co., To-
ronto**
Sanderson, Pearcey & Co., Ltd., Toronto

PAINTS (Roof)

Alderson, Hammond & Ritchie, Ltd., Toronto
 Bird, F. W., & Son, East Walpole, Mass.
 Brantford Roofing Co., Ltd., Brantford
 Canadian H. W. Johns-Manville Co., Ltd., Toronto
 Canadian Supply & Contracting Co., Toronto
 Carey, Phillip Co., Toronto
 Dominion Paint Works, Ltd., Walkerville
 Electric Paint & Varnish Co., Cleveland
Harland, Wm., & Son, Toronto
 Glidden Varnish Co., Toronto
Imperial Varnish & Color Co., Ltd., Toronto
 International Varnish Co., Ltd., Toronto
Jamieson, R. C., Ltd., Montreal
Lowe Bros., Ltd., Toronto
 Martin-Senour Co., Ltd., Montreal
Moore, Benj., & Co., Ltd., Toronto
 Pinchin, Johnson Co. (Canada), Ltd., Toronto
R. I. W. Damp Resisting Paint Co., Toronto
 Roofers' Supply Co., Ltd., Toronto
Sanderson, Percy Co., Ltd., Toronto
 Sturgeons, Ltd., Toronto
Trussed Concrete Steel Co. of Canada, Ltd., Walkerville

PANELBOARDS (Electric)

Hill Electric Switch & Mfg. Co., Ltd., Montreal
Crouse-Hinds & Co., Ltd., Toronto

PAPER (Building, Insulating & Sheathing)

Aikenhead Hardware Co., Toronto
 Bird, F. W., & Son, Hamilton
 Cabot, Samuel, Inc., Boston, Mass.
 Canadian Supply & Contracting Co., Toronto
 Carey, Phillip Co., Toronto
 Pedlar People, Oshawa
 Roofers' Supply Co., Ltd., Toronto
Rutherford, Wm., & Sons Co., Ltd., Montreal
Russell Hardware, Toronto

PAPER (Wall)

Elliott & Son, Ltd., Toronto
 Tiffany Studios, New York
 Wood Bros., Montreal

PARALLEL DOOR EQUIPMENT

Allith Mfg. Co., Ltd., Hamilton
 Richards-Wilcox Mfg. Co., London
Van Dorn Mfg. Co., Cleveland

PARTITIONS (Fireproof)

Douglas Bros., Toronto

PARTITIONS (Rolling)

Stinson-Reeb Builders' Supply Co., Ltd., Montreal
 Walker Bin & Store Fixture Co., Berlin
Watson, Ltd., Bradford
Wilson, Jas. G., Mfg. Co., New York

PAVING (Granite)

Argenteuil Granite Co., Ltd., Montreal
Stinson-Reeb Builders' Supply Co., Ltd., Montreal

PILASTERS (Granite)

Smith Marble & Construction Co., Ltd., Montreal

FILES (Concrete)

MacArthur Concrete Pile & Foundation Co., New York

PILES (Steel)

Hankin, Francis, & Co., Montreal
MacArthur Concrete Pile Co., New York

PIPES (Bends)

Canadian Kellogg Co., Ltd., Montreal
Conduits, Ltd., Toronto
 Manitoba Bridge & Iron Works, Winnipeg

PIPE (Gas)

Consumers' Gas Co., Toronto

PIPE (Iron)

Canada Foundry Co., Ltd., Toronto
Cluff Bros., Toronto
 Empire Mfg. Co., Ltd., London
 Warden, King, Ltd., Montreal

PIPE (Lead, Tin)

Cluff Bros., Toronto
 Empire Mfg. Co., London
 Warden, King, Ltd., Montreal

PIPE (Sewer or Clay)

Gaudry, L. H., & Co., Ltd., Quebec
 Hamilton & Toronto Sewer Pipe Co., Hamilton
 Ontario Sewer Pipe Co., Ltd., Toronto
 Ramsay & Kelly, Montreal
Stinson-Reeb Builders' Supply Co., Montreal

PIPE (Soil, and Fittings)

Canadian Fairbanks-Morse Co., Ltd., Montreal
Cluff Bros., Toronto
 Dominion Radiator Co., Ltd., Toronto
 Empire Mfg. Co., Ltd., London
 Gaudry, L. H., & Co., Ltd., Quebec
Morrison, Jas., Brass Mfg. Co., Toronto
 Standard Ideal Co., Port Hope
 Standard Sanitary Co., Ltd., Toronto
 Steel & Radiation, Toronto
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
 Warden, King, Ltd., Montreal

PIPE (Steel)

Boving & Co. of Canada, Ltd., Toronto
 Canadian Allis-Chalmers, Ltd., Toronto
 Canadian Kellogg Co., Ltd., Montreal
 Leonard, E. & Sons, London
Waterous Engine Works Co., Ltd., Brantford

PIPE (Wrought Iron)

Canada Foundry Co., Ltd., Toronto
 Canadian Fairbanks-Morse Co., Ltd., Montreal
 Canadian Kellogg Co., Ltd., Montreal
Cluff Bros., Toronto
 Dominion Radiation Co., Ltd., Toronto
 Empire Mfg. Co., London
Goldie & McCulloch, Ltd., Galt
Keiths, Ltd., Toronto
Sheldons, Ltd., Galt
 Steel & Radiation, Ltd., Toronto

PLASTER

Alabastine Co., Ltd., Paris
 Alabastine Hard Mortar Co., Toronto
 Britnell & Co., Toronto
 Crown Gypsum Co., Ltd., Lythmore
Dancy, R. C., Toronto
 Dominion Gypsum Co., Ltd., Winnipeg
 Hoidge & Sons, Toronto
 Hynes, W. J., Toronto
 Manitoba Gypsum Co., Ltd., Winnipeg
 Ontario Lime Co., Ltd., Toronto
 Ramsay & Kelly, Montreal
Stinson-Reeb Builders' Supply Co., Montreal

PLASTER BOARD

Aikenhead Hardware Co., Toronto
 Carey, Phillips Co., Toronto
 Crown Gypsum Co., Ltd., Lythmore
 Dominion Gypsum Co., Ltd., Winnipeg
 Manitoba Gypsum Co., Ltd., Winnipeg
Shearer, Jas., Co., Ltd., Montreal
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
 United States Gypsum Co., Chicago

PLASTERING

Dancy, R. C., Toronto
 Dominion Gypsum Co., Ltd., Winnipeg
 Hoidge & Sons, Toronto
 Hynes, Wm. J., Toronto

PLASTER OF PARIS

Alabastine Co., Ltd., Paris
Ontario Lime Ass'n, Toronto
Ramsay & Kelly, Montreal
Sanderson, Pearcey & Co., Ltd., Toronto

PLASTER ORNAMENTS

Dancy, R. C., Toronto
Dominion Gypsum Co., Ltd., Winnipeg
Hoidge & Sons, Toronto
Hynes, Wm. J., Toronto
McCormack & Carroll, Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Smith Marble & Construction Co., Ltd., Montreal

PLUMBERS' & STEAMFITTERS' SUPPLIES

Aikenhead Hardware Co., Toronto
Bennett & Wright Co., Ltd., Toronto
B. O. T. Mfg. Co., Ltd., Toronto
Canadian Consolidated Rubber Co., Montreal
Canadian H. W. Johns-Manville Co., Ltd., Toronto
Canadian Wolverine Co., Ltd., Chatham
Cluff Bros., Toronto
Dietrich, Ltd., Galt
Empire Mfg. Co., Ltd., London
Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
Mueller, H., Mfg. Co., Sarnia
O'Neil, Wm. N., Co., Ltd., Vancouver
Smith Marble & Construction Co., Ltd., Montreal
Standard Ideal Co., Ltd., Port Hope
Standard Sanitary Co., Ltd., Toronto
Warden, King, Ltd., Montreal

PLUMBING FIXTURES

B. O. T. Mfg. Co., Toronto
Cluff Bros., Toronto
Robertson, Jas. G., Co., Toronto
Standard Ideal Co., Ltd., Port Hope
Standard Sanitary Co., Toronto

PORTLAND CEMENT

Canada Cement Co., Ltd., Montreal
Rogers, Alfred, Ltd., Toronto

POST CAPS & BASES

Duplex Hanger Co., Cleveland
Hobbs Mfg. Co., Ltd., London
Van Dorn Mfg. Co., Cleveland

POTTERY

American Terra Cotta Co., Chicago
Atlantic Terra Cotta Co., New York
Doulton Co., Ltd., London, Eng.
Gibbs & Canning, Ltd., Toronto
North Western Terra Cotta Co., Chicago
Siebert, Geo. E., Winnipeg
Waite-Fullerton Co., Ltd., Winnipeg

PRESERVATIVES (Wood)

Aikenhead Hardware Co., Toronto
Bruno Grosche Co., New York
Cabot, Samuel, Inc., Boston
Carbolineum Wood Preserving Co., New York
Carey, Phillip, Co., Toronto
International Varnish Co., Ltd., Toronto
Lowe Bros., Ltd., Toronto
Northeastern Co., Boston
Pratt & Lambert, Bridgeburg
Sturgeons, Ltd., Toronto

PRISMS (Sidewalk, Skylight & Pavement)

Hobbs Mfg. Co., Ltd., London
Luxfer Prism Co., Ltd., Toronto

PULLEYS (Belt)

American Pulley Co., Philadelphia
Berg Machinery Mfg. Co., Ltd., Toronto
Canadian Fairbanks-Morse Co., Ltd., Montreal
Elmira Machinery & Transmission Co., Elmira
Goldie & McCulloch, Ltd., Galt
Jeffrey Mfg. Co., Columbus
Manitoba Bridge & Iron Works, Winnipeg

Sheldons, Ltd., Galt

Waterous Engine Works, Brantford

PULLEYS (Wood, Steel, Split, Iron & Friction)

Berg Machinery Mfg. Co., Ltd., Toronto
Canadian Fairbanks-Morse Co., Ltd., Montreal
Goldie & McCulloch Co., Ltd., Galt
Manitoba Bridge & Iron Works, Ltd., Winnipeg
Miller Bros. & Sons, Montreal
Sheldons, Ltd., Galt

PUMPS

Bawden Machine Co., Ltd., Toronto
Beatty & Sons, M., Welland
Boving & Co. of Canada, Ltd., Toronto
Canada Foundry Co., Ltd., Toronto
Canadian Buffalo Forge Co., Montreal
Canadian Fairbanks-Morse Co., Ltd., Montreal
Canadian Ingersoll-Rand Co., Montreal
Canadian Sirocco Co., Ltd., Windsor
Dunham, C. A., Co., Ltd., Toronto
Empire Mfg. Co., London
Goldie & McCulloch Co., Ltd., Galt
Goold, Shapley & Muir Co., Ltd., Brantford
Hopkins, F. H., & Co., Montreal
Ingles, Jno. & Co., Toronto
Laurie & Lambe, Montreal
Lister, R. A., & Co., Toronto
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
Mussens, Ltd., Montreal
National Equipment Co., Ltd., Toronto
Smart-Turner Machine Co., Hamilton
Wettlaufer Bros., Toronto

PUMPS (Air)

Bawden Machine Co., Ltd., Toronto
Canada Foundry Co., Ltd., Toronto
Laurie & Lamb, Montreal
National Equipment Co., Ltd., Toronto

PUMPS (Centrifugal)

Boving & Co. of Canada, Ltd., Toronto
Empire Mfg. Co., Ltd., London
Escher, Wyss & Co., Toronto
Hare Engineering Co., Toronto
Leonard, E., & Sons, London
Smart-Turner Machine Co., Hamilton
Waterous Engine Works Co., Brantford
Wettlaufer Bros., Toronto

PUMPS (Oil)

Aikenhead Hardware Co., Toronto
Bawden Machine Co., Toronto
Bowser, S. F., & Co., nc., Toronto
Canadian Fairbanks-Morse Co., Ltd., Montreal
Mitchell, Robt., Co., Ltd., ETAOINETAOI
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
National Equipment Co., Toronto
Smart-Turner Machine Co., Hamilton
Wettlaufer Bros., Toronto

PUMPS (Turbine)

Boving & Co. of Canada, Ltd., Toronto
Canadian Allis-Chalmers Co., Ltd., Toronto
Escher, Wyss Co., Montreal
Ingles, Jno., Co., Toronto
McDougall, Caledonian Iron Works, Ltd., Montreal
Smart-Turner Machine Co., Hamilton

PUMPS (Vacuum)

Allen, W. H., Son & Co., Bedford, Eng.
American Steam Pump Co., Battlecreek, Mich.
Bawden Machine Co., Toronto
Boving & Co. of Canada, Ltd., Toronto
Canada Foundry Co., Ltd., Toronto
Canadian Allis-Chalmers, Ltd., Toronto
Dunham, C. A., Co., Toronto
Hare Engineering Co., Toronto
Ingles, Jno., Co., Toronto
Laurie & Lambe, Montreal
Leonard, E., & Sons, London

PUMPS (Vacuum)—Continued

Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
National Equipment Co., Ltd., Toronto
Polson Iron Works, Ltd., Toronto
Smart-Turner Machine Co., Hamilton
Wettlaufer Bros., Toronto

PUMP VALVES (Rubber)

Canadian H. W. Johns-Manville Co., Ltd., Toronto
Consolidated Rubber Co., Ltd., Montreal
Carey, Phillip, Co., Toronto

PURIFIERS

Canada Foundry Co., Ltd., Toronto
Laurie & Lambe, Montreal
Manitoba Bridge & Iron Works, Ltd., Winnipeg

R**RADIATORS**

Canadian Rector Gas Heating Co., Ltd., Hamilton
Clare Bros. & Co., Ltd., Preston
Dominion Radiator Co., Ltd., Toronto
Empire Mfg. Co., Ltd., London
Steel & Radiation, Ltd., Toronto
Taylor-Forbes, Ltd., Guelph
Warden, King, Ltd., Montreal

RAILINGS (Wrought Iron, Brass or Bronze)

Alkenhead Hardware Co., Toronto
Canadian Ornamental Iron Co., Ltd., Toronto
Dennis Wire & Iron Works, London
Dominion Ornamental Iron Co., Ltd., Toronto
Estey Bros. Co., Montreal
Meadows, Geo. B., Toronto
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

RAILWAY (Industrial & Equipment)

Canadian Steel Foundries, Ltd., Montreal
Hopkins, F. H., & Co., Montreal
Mussens, Ltd., Montreal
Orenstein-Arthur Koppel Co., New York

RANGE CLOSETS & URINALS

B. O. T. Mfg. Co., Ltd., Toronto
Cluff Bros., Toronto
Empire Mfg. Co., Ltd., London
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Warden, King Co., Ltd., Montreal

RANGES (Coal, Wood or Gas)

Bowman Gas Range Mfg. Co., Toronto
Clare Bros. & Co., Ltd., Preston
Consumers' Gas Co., Ltd., Toronto
McClary Mfg. Co., London
Stewart, Jas., Mfg. Co., Woodstock
Siche Gas Co., Ltd., Toronto
Welch, A., & Son, Toronto

RECEPTORS (Porcelain Enamelled)

B. O. T. Mfg. Co., Ltd., Toronto
Cluff Bros., Toronto
Standard Ideal Co., Ltd., Port Hope
Standard Sanitary Co., Toronto

REFLECTORS (Roundhouse, Industrial)

Crouse-Hinds, Ltd., Toronto

REFRIGERATING MACHINERY

Arctic Ice Machine Co., Canton, O.
Canada Ice Machine Co., Ltd., Toronto
Canadian H. W. Johns-Manville Co., Ltd., Toronto
Keiths, Ltd., Toronto
Linde Canadian Refrigeration Co., Ltd., Montreal
Vilter Mfg. Co., Milwaukee, Wis.
Waterous Engine Works Co., Ltd., Brantford
York Mfg. Co., York, Pa.

REFRIGERATORS

Eureka Refrigerator Co., Ltd., Toronto
Hillock & Son, Ltd., Toronto

McClary Refrigerator Co., Kindelville, Ind.

McClary Mfg. Co., Ltd., London
Siebert, Geo. E., Winnipeg

REGISTERS (Hot Air or Ventilating)

Clare Bros. & Co., Ltd., Preston
Dominion Architectural Iron Works, Ltd., Montreal
McClary Mfg. Co., London
Pease Foundry Co., Ltd., Toronto
Smart, Jas., Mfg. Co., Brockville
Stewart, Jas., Mfg. Co., Woodstock
Tuttle & Bailey, Bridgeburg

REGULATORS

Boving & Co. of Canada, Ltd., Toronto
Canadian Buffalo Forge Co., Ltd., Montreal
Canadian Powers Regulator Co., Ltd., Toronto
Dunham, C. A., Co., Ltd., Toronto
Johnson Temperature Regulating Co. of Canada, Ltd., Toronto
Sheldons, Ltd., Galt

REINFORCED CONCRETE FLOORS

(See Floors, Reinforced Concrete)

RELIEF DECORATIONS

Dancy, R. C., Toronto
Hoidge & Sons, Toronto
Hynes, Wm. J., Toronto
McCormack & Carroll, Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver

RELIEF PLASTER

Balmer & Blakeley, Toronto
Dancy, R. C., Toronto
Dominion Gypsum Co., Ltd., Winnipeg
Hoidge & Sons, Toronto
Hynes, Wm. J., Toronto
McCormack & Carroll, Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
United States Gypsum Co., Chicago

ROCK CRUSHERS

Wettlaufer Bros., Toronto

ROLLING DOORS & SHUTTERS

Kinnear Mfg. Co., Columbus, Ohio
Ormsby, A. B., Co., Toronto
Watson, Ltd., Bradford
Wilson, Jas. G., Mfg. Co., New York

ROLLING PARTITIONS

(See Partitions, Rolling)

ROOFING (Asbestos)

Asbestos Mfg. Co., Ltd., Montreal
Canadian H. W. Johns-Manville Co., Ltd., Toronto
Douglas Bros., Toronto
Reed, Geo. W., & Co., Ltd., Montreal
Ormsby, A. B., Ltd., Toronto

ROOFING (Asphalt)

Canadian H. W. Johns-Manville Co., Ltd., Toronto
Carey, Phillip, Co., Toronto
Douglas Bros., Toronto
Ormsby, A. B., Ltd., Toronto
Reed, Geo. B., & Co., Ltd., Montreal
Roofers' Supply Co., Ltd., Toronto
Trussed Concrete Steel Co. of Canada, Ltd., Walkerville
Walkerville Roofing Mfg. Co., Ltd., Walkerville
Winnipeg Ceiling & Roofing Co., Winnipeg

ROOFING CONTRACTORS

Canadian Supply & Contracting Co., Toronto
Reggin & Spence, Toronto

ROOFING MATERIAL

Bird, F. W., & Son, Hamilton
Brantford Roofing Co., Ltd., Brantford
Cushing Bros. Co., Ltd., Calgary
Douglas Bros., Toronto
Ludowici-Celadon Co., Chicago

ROOFING MATERIAL—Continued

O'Neil, Wm. N., Co., Ltd., Vancouver
Ormsby, A. B., Co., Ltd., Toronto
Pedlar People, Ltd., Oshawa
Roofers' Supply Co., Ltd., Toronto
Waite-Fullerton Co., Ltd., Winnipeg

ROOFING (Metal)

Douglas Bros., Toronto
Leslie, A. C., & Co., Ltd., Montreal
Metallic Roofing Co., Ltd., Toronto
Sheldons, Ltd., Galt

ROOFING (Prepared or Ready)

Asbestos Mfg. Co., Ltd., Montreal
Bird, F. W., & Son, Hamilton
Brantford Roofing Co., Brantford
Canadian H. W. Johns-Manville Co., Ltd., Toronto
Carey, Phillip Co., Toronto
Douglas Bros., Toronto
Ormsby, A. B., Co., Ltd., Toronto
Paterson Mfg. Co., Ltd., Toronto
Roofers' Supply Co., Ltd., Toronto

ROOFING (Slate)

Douglas Bros., Toronto
Ormsby, A. B., Co., Ltd., Toronto
Smith Marble Construction Co., Ltd., Montreal
Waite-Fullerton Co., Ltd., Winnipeg

ROPE (Wire)

Canada Wire & Cable Co., Toronto
Greening, B., Wire Co., Hamilton
Hopkins, F. H., & Co., Montreal
Imperial Wire & Cable Co., Ltd., Montreal
Mussens, Ltd., Montreal
Otis-Fensom Elevator Co., Toronto
Steel Co. of Canada, Hamilton
Tennant, C., Sons & Co., Ltd., Montreal
Wettlaufer Bros., Toronto

RUBBER BELTING

Canadian Consolidated Rubber Co., Montreal

S

SAFES (Bankers')

Ahern Safe Co., Ltd., Montreal
Dominion Safe & Vault Co., Ltd., Farnham, Que.
Goldie & McCulloch Co., Ltd., Galt
Taylor, J. & J., Ltd., Toronto

SAFES (Fireproof)

Ahern Safe Co., Ltd., Montreal
Dominion Safe & Vault Co., Ltd., Farnham, Que.
Goldie & McCulloch, Ltd., Galt
Taylor, J. & J., Ltd., Toronto

SAFES (Wall)

Ahern Safe Co., Ltd., Montreal
Aikenhead Hardware Co., Toronto

SAND

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
Sand & Supplies, Ltd., Toronto
Stinson-Reeb Builders' Supply Co., Ltd., Montreal

SASH & FRAMES (Steel)

Aikenhead Hardware Co., Toronto
Canadian Ornamental Iron Co., Toronto
Douglas Bros., Toronto
Dennis Wire & Iron Works, London
Hankin, Francis, & Co., Montreal
Hope, Henry, & Sons, Toronto
O'Neil, Wm. N., & Co., Ltd., Vancouver
Ormsby, A. B., Co., Ltd., Toronto
Steel & Radiation, Ltd., Toronto
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
Trussed Concrete Steel Co. of Canada, Ltd., Walkerville
Watson, Jno., & Son, of Montreal, Ltd.,

SASH & FRAMES (Wood)

Batts, Ltd., Toronto

Canada Lumber Co., Ltd., Toronto
Cushing Bros. Co., Ltd., Calgary
Delaplante, Ltd., L. A., Toronto
Knight Bros. Co., Ltd., Burk's Falls
Laidlaw Lumber Co., Toronto
Lickley, H. M., Ltd., Toronto
Powell Lumber & Door Co., Ltd., Toronto
Rhodes-Curry Co., Ltd., Amherst
Rutherford, Wm., & Son, Montreal
Webb Lumber Co., Ltd., Toronto

SASH OPERATORS & GEARING

Alza Co., Ltd., Montreal
Dearborn Hardware Mfg. Co., Chicago
O'Neil, Wm. N., Co., Ltd., Vancouver
Ormsby, A. B., Ltd., Toronto

SCHOOL FURNITURE

Berlin Interior Hardwood Co., Ltd., Berlin
Globe Furniture Co., Ltd., Waterloo
Knight Bros. Co., Ltd., Burk's Falls
Rhodes-Curry Co., Ltd., Amherst
Walker Bin & Store Fixture Co., Ltd., Berlin

SCREENS (Coal, Gravel, Rock or Sand)

Aikenhead Hardware Co., Toronto
Canada Wire & Iron Goods Co., Hamilton
Wettlaufer Bros., Toronto
Waterous Engine Works Co., Ltd., Brantford

SCREENS (Door or Window)

Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London
Higgin Mfg. Co., Toronto
Peace, Wm., Co., Ltd., Hamilton
Rhodes-Curry Co., Ltd., Amherst
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
Watson, Ltd., Bradford
Wilson, Jas. G., Mfg. Co., New York
Window Strip Co., Montreal

SCREENS (Fly)

Peace, Wm. Co., Ltd., Hamilton
Watson, Ltd., Bradford
Window Strip Co., Montreal

SCULPTORS & MODELERS

Canadian Art Stone Co., Ltd., Toronto
Dancy, R. C., Toronto
Dominion Gypsum Co., Ltd., Winnipeg
Hynes, Wm. J., Toronto
O'Neil, Wm. N., Co., Ltd., Vancouver
Stinson-Reeb Builders' Supply Co., Ltd., Montreal

SEATS (Garden)

Canada Wire & Iron Goods Co., Hamilton
Waite-Fullerton Co., Ltd., Winnipeg
Watson, Jno., & Son, of Montreal, Ltd., Montreal

SEPARATORS (Steam)

Arctic Ice Machine Co., Canton, O.
Canadian Allis-Chalmers Co., Ltd., Toronto
Canadian Buffalo Forge Co., Ltd., Montreal
Darling Bros., Montreal
Dunham, C. A., Co., Toronto
Elliott Co., Pittsburgh
Hare Engineering Co., Toronto
Sheldons, Ltd., Galt
Smart-Turner Machine Co., Hamilton
Watson & McDaniel Co., Philadelphia

SEARCHLIGHTS (Electric)

Crouse-Hinds, Ltd., Toronto

SHAFTING

Berg Machinery Mfg. Co., Ltd., Toronto
Canadian Fairbanks-Morse Co., Ltd., Montreal
Goldie & McCulloch Co., Ltd., Galt
Manitoba Bridge & Iron Works, Ltd., Winnipeg
Miller Bros. & Sons, Montreal
Polson Iron Works, Ltd., Toronto
Sheldons, Ltd., Galt
Waterous Engine Works Co., Ltd., Brantford

SHEATHING (Gilt)

Alsip Brick, Tile & Lumber Co., Ltd.,
Winnipeg
Cabot, Samuel, Inc., Boston

SHEET METAL WORK

Aikenhead Hardware Co., Toronto
Alsip Brick, Tile & Lumber Co., Winnipeg
Canada Wire & Iron Goods Co., Hamilton
Leslie, A. C., & Co., Ltd., Montreal
McClary Mfg. Co., London
Ormsby, A. B., Ltd., Toronto
Pedlar People, Oshawa
Polson Iron Works, Toronto
Roofers' Supply Co., Ltd., Toronto
Sheldons, Ltd., Galt
United States Steel Products Co., New
York
Waterous Engine Works, Brantford

SHELVING (Steel)

Dennis Wire & Iron Works Co., Ltd., Lon-
don

SHINGLES (Asbestos)

Asbestos Mfg. Co., Ltd., Montreal
Canadian H. W. Johns-Manille Co., Ltd.,
Toronto

SHINGLES (Steel)

Alsip Brick, Tile & Lumber Co., Ltd.,
Winnipeg
O'Neil, Wm. N., Co., Ltd., Vancouver
Ormsby, A. B., Co., Ltd., Toronto
Pedlar People, Ltd., Oshawa

SHUTTERS (Fireproof, Rolling)

Kinnear Mfg. Co., Columbus O.
Wilson, Jas. Co., Mfg. Co., New York

SHUTTERS (Iron)

Canada Foundry Co., Ltd., Toronto
Canadian Ornamental Iron Co., Ltd., To-
ronto
Dennis Wire & Iron Works Co., Ltd., Lon-
don
Douglas Bros., Toronto
Gaudry, L. H., & Co., Ltd., Quebec
Kinnear Mfg. Co., Ltd., Columbus
Ormsby, A. B., Co., Ltd., Toronto
Pedlar People, Ltd., Oshawa
Steel & Radiation, Ltd., Toronto
Watson, John, & Son, of Montreal, Ltd.,
Montreal
Wilson, Jas. G., Mfg. Co., New York

SHUTTERS (Rolling Steel)

Kinnear Mfg. Co., Columbus
Wilson, Jas. G., Mfg. Co., New York

SIGNS (Metal)

Booth, Geo., & Son, Toronto
Canadian Ornamental Iron Co., Ltd., To-
ronto
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Goods Co., London
Estey Bros. Co., Montreal
Meadows, Geo. B., Toronto
Mitchell, Robt., Co., Ltd., Montreal
O'Neil, Wm. N., Co., Ltd., Vancouver
Richardson, J. E., & Co., Toronto

SINK DRAIN BOARDS (Porcelain Enamelled)

Cluff Bros., Toronto
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto
Standard Ideal Co., Ltd., Port Hope
Standard Sanitary Co., Ltd., Toronto

SINK MATS (Wire)

Cluff Bros., Toronto
Standard Ideal Co., Ltd., Port Hope
Standard Sanitary Co., Ltd., Toronto

SINK MATS (Wood)

Cluff Bros., Toronto

SINKS

Cluff Bros., Toronto
Empire Mfg. Co., Ltd., London
McClary Mfg. Co., London

Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto
Smith Marble & Construction Co., Ltd.,
Montreal
Warden, King, Ltd., Montreal

SINKS & SINK FIXTURES (Porcelain)

B. O. T. Mfg. Co., Ltd., Toronto
Cluff Bros., Toronto
Empire Mfg. Co., Ltd., London

SINK TRAPS

B. O. T. Mfg. Co., Ltd., Toronto
Cluff Bros., Toronto
Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto
Stinson-Reeb Builders' Supply Co., Ltd.,
Montreal
Standard Ideal Co., Ltd., Port Hope
Standard Sanitary Co., Ltd., Toronto
Warden, King, Ltd., Montreal

SINK TRAPS (Porcelain Enamelled)

Cluff Bros., Toronto
Morrison, Jas., Brass Mfg. Co., Toronto
Stinson-Reeb Builders' Supply Co., Ltd.,
Montreal

SKYLIGHTS

Douglas Bros., Toronto
Gaudry, L. H., & Co., Ltd., Quebec
Metal Shingle & Siding Co., Preston
Ormsby, A. B., Co., Ltd., Toronto
Pedlar People, Ltd., Oshawa
Winnipeg Ceiling & Roofing Co., Winni-
peg

SLATE BLACKBOARDS

(See Blackboards, Slate)

SLATE ROOFING

(See Roofing Slate)

SLATE (Stair Tread)

Dominion Marble Co., Ltd., Montreal
Gaudry, L. H., & Co., Ltd., Quebec
O'Neil, Wm. N., Co., Ltd., Vancouver
Smith Marble & Construction Co., Ltd.,
Montreal

SLOP HOPPERS

Cluff Bros., Toronto
Empire Mfg. Co., Ltd., London
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto
Warden, King, Ltd., Montreal

SLOP HOPPERS (Porcelain Enamelled)

B. O. T. Mfg. Co., Ltd., Toronto
Cluff Bros., Toronto
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto

SOUND DEADENING MATERIALS

Braid & McCurdy, Winnipeg
Cabot, Samuel, Inc., Boston, Mass.
Canadian H. W. Johns-Manville Co., Ltd.,
Toronto
Carey, Phillip Co., Toronto

SPRINKLER HEADS & SYSTEMS

General Fire Equipment Co., Toronto
Keiths, Ltd., Toronto
McGuire, W. J., Ltd., Toronto
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto
Vogel & Co., Ltd., Montreal

STABLE FITTINGS & FIXTURES

Aikenhead Hardware Co., Toronto
Beatty Bros., Ltd., Fergus
Dennis Wire & Iron Works, London
Gaudry, L. H., & Co., Ltd., Quebec
Manitoba Bridge & Iron Works, Winnipeg
O'Neil, Wm. N., Co., Ltd., Vancouver
Tisdale Iron Stable Fittings Co., Toronto
Warden, King, Ltd., Montreal
Watson, Jno., & Son of Montreal, Ltd.,
Montreal

STAFF (Plaster, Decorations & Mouldings)

Crown Gypsum Co., Ltd., Lythmore
Dancy, R. C., Toronto
 Hoidge & Sons, Toronto
 Hynes, Wm. J., Toronto
 Knight Bros. & Co., Ltd., Burk's Falls
 McCormack & Carroll, Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver

STAINED GLASS

(See Glass, Stained or Leaded)

STAINS & FILLERS

Ronuk, Ltd., Toronto
Bate, W. B., & Co., Toronto

STAINS (Brick, Cement, Waterproof)

Cabot, Samuel, Inc., Boston
 Carey, Phillip, Co., Toronto
 Electric Paint & Varnish Co., Cleveland
 Glidden Varnish Co., Toronto
Harland, Wm., & Son, Toronto
Jamieson, R. C., & Co., Montreal
Lowe Bros., Ltd., Toronto
Moore, Benj., & Co., Ltd., Toronto
 Patton Paint Co., Newark
 Pinchin, Johnson Co., Canada, Ltd., Toronto
R. I. W. Damp Resisting Paint Co., Toronto
 Sturgeons, Ltd., Toronto
Trussed Concrete Steel Co. of Canada, Ltd., Walkerville

STAINS (Oil & Creosote)

Electric Paint & Varnish Co., Cleveland
 Glidden Varnish Co., Ltd., Toronto
Imperial Varnish & Color Co., Ltd., Toronto
Jamieson, R. C., & Co., Ltd., Montreal
Lowe Bros., Ltd., Toronto
Moore, Benj., & Co., Toronto
 Patton Paint Co., Newark, N.J.
 Pratt & Lambert, Bridgeburg
Sanderson, Percy & Co., Ltd., Toronto
 Sturgeons, Ltd., Toronto

STAINS (Shingle)

Aikenhead Hardware Co., Toronto
 Braid & McCurdy, Winnipeg
 Cabot, Samuel, Inc., Boston
 Electric Paint & Varnish Co., Cleveland
 Glidden Varnish Co., Toronto
Harland, Wm., & Son, Toronto
 International Varnish Co., Ltd., Toronto
 Langmuir, Jas., & Co., Ltd., Toronto
Lowe Bros., Ltd., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Pinchin, Johnson Co., Canada, Ltd., Toronto
 Sturgeons, Ltd., Toronto

STAINS (Wood)

Cabot, Samuel, Inc., Boston, Mass.
 Electric Paint & Varnish Co., Cleveland
 Glidden Varnish Co., Toronto
 International Varnish Co., Ltd., Toronto
Jamieson, R. C., & Co., Ltd., Toronto
 Langmuir, Jas., & Co., Ltd., Toronto
Lowe Bros., Ltd., Toronto
 Martin-Senour Co., Ltd., Montreal
Moore, Benj., & Co., Toronto
 Patton Paint Co., Newark, N.J.
 Pinchin, Johnson & Co. (Canada), Ltd., Toronto
 Pratt & Lambert, Bridgeburg
Sanderson, Percy & Co., Ltd., Toronto
 Sturgeons, Ltd., Toronto

STAIRS (Cast Iron, Steel & Bronze)

Aikenhead Architectural Metal Works, Toronto
Canadian Ornamental Iron Co., Ltd., Toronto
Dennis Wire & Iron Works, London
Estey Bros. Co., Montreal
 Gaudry, L. H., & Co., Ltd., Quebec
Meadows, Geo. B., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Watson, John, & Son of Montreal, Ltd., Montreal

STAIR TREADS (Cork)

Kennedy, David E., Inc., Montreal
Robinson Bros. Cork Co., Toronto

STAIR TREADS (Marble)

Dominion Marble Co., Ltd., Montreal
 Gaudry, L. H., & Co., Ltd., Quebec
 Hoidge Marble Co., Toronto
Lautz-Dunham Co., Toronto
 Missisquoi Marble Co., Ltd., Montreal
 O'Neil, Wm. N., Co., Ltd., Vancouver
Smith Marble & Construction Co., Ltd., Montreal

STAIR TREADS (Rubber)

Canadian Consolidated Rubber Co., Montreal

STAIR TREADS (Slate)

Dominion Marble Co., Ltd., Montreal
 Gaudry, L. H., & Co., Ltd., Quebec
Lautz-Dunham Co., Ltd., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver
Smith Marble & Construction Co., Ltd., Montreal

STEAM & HOT WATER FITTINGS & SPECIALTIES

Aikenhead Hardware Co., Toronto
 Canada Foundry Co., Ltd., Toronto
Cluff Bros., Toronto
 Darling Bros., Montreal
 Dominion Radiator Co., Ltd., Toronto
Dunham, C. A., Co., Ltd., Toronto
 Empire Mfg. Co., Ltd., London
Goldie & McCulloch Co., Ltd., Galt
 Liberty Mfg. Co., Pittsburgh
 Lunkenheimer Co., Cincinnati
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
 Ohio Brass Co., Mansfield, O.
 Pease Foundry Co., Ltd., Toronto
 Pemberthy Injector Co., Windsor
Sheldons, Ltd., Galt
 Steel & Radiation, Ltd., Toronto
 Sturtevant, B. F., Co. of Canada, Ltd., Montreal
 Taylor-Forbes Co., Ltd., Guelph
 Warden, King, Ltd., Montreal
Waterous Engine Works Co., Ltd., Brantford
 Watson & McDaniel Co., Philadelphia

STEAMBOAT SUPPLIES

Canadian Fairbanks-Morse Co., Ltd., Montreal
 Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

STEAMBOAT SUPPLIES (Porcelain Enamelled Ware)

B. O. T. Mfg. Co., Ltd., Toronto
Cluff Bros., Toronto
 Empire Mfg. Co., Ltd., London
 Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., Toronto
 Standard Ideal Co., Ltd., Port Hope
 Standard Sanitary Co., Ltd., Toronto

STEAM FIRE PUMP VALVES

Canadian Consolidated Rubber Co., Montreal

STEEL RODS, BEAMS & SHAPES

Canada Foundry Co., Ltd., Toronto
 Canadian Bridge Co., Ltd., Walkerville
Dennis Wire & Iron Works Co., Ltd., London
 Dominion Bridge Co., Ltd., Montreal
 Eastern Canada Steel & Iron Works, Ltd., Quebec
 Gaudry, L. H., & Co., Ltd., Quebec
Leslie, A. C., & Co., Ltd., Montreal
 Manitoba Bridge & Iron Works, Ltd., Winnipeg
 Steel & Radiation, Ltd., Toronto
Structural Steel Co., Ltd., Montreal

STEEL WOOL & STEEL SHAVINGS

Ronuk, Ltd., Toronto

STONE (All Kinds)

Dominion Marble Co., Ltd., Montreal
 Missisquoi Marble Co., Ltd., Montreal
 Penn, Wm., Stone Co., Minneapolis
 Stinson-Reeb Builders' Supply Co., Ltd., Montreal

STONE (Artificial)

Canadian Art Stone Co., Ltd., Toronto
 Cement Products, Ltd., Toronto
 Corinthian Stone Co., Guelph
 Dartnell, Ltd., Montreal
 Hankin, Francis, Ltd., Montreal
 Monarch Stone Co., Toronto
 Roman Stone Co., Ltd., Toronto
 Stinson-Reeb Builders' Supply Co., Ltd., Montreal
 Toronto Ornamental Stone Co., Toronto

STONE (Crushed)

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
 Argenteuil Granite Co., Ltd., Montreal
 Canada Lumber Co., Ltd., Toronto
 Canadian Crushed Stone Corporation, Dundas
 Crushed Stone, Ltd., Toronto
 Dominion Marble Co., Ltd., Montreal
 Hagersville Contracting Co., Ltd., Hagersville
 Sand & Supplies, Ltd., Toronto
 Stinson-Reeb Builders' Supply Co., Ltd., Montreal

STONE (Sand, Ohio)

Ohio Quarries Co., Cleveland

STORE FITTINGS & FIXTURES

Batts, Ltd., Toronto
 Berlin Interior Hardwood Co., Ltd., Berlin
 Blonde Lumber & Mfg. Co., Chatham
 Cushing Bros. Co., Ltd., Calgary
 Dennis Wire & Iron Works, London
 Green Bros., Toronto
 Lickley, H. M., Ltd., Toronto
 Knight Bros. & Co., Ltd., Burk's Falls
 Laidlaw, R., Co., Ltd., Toronto
 Metal Shingle & Siding Co., Preston
 Mitchell, Robt., Co., Ltd., Montreal
 Rhodes-Curry Co., Ltd., Amherst
 Richards-Wilcox Mfg. Co., London
 Rutherford, Wm., & Son, Ltd., Montreal
 Walker Bin & Store Fixture Co., Berlin
 Webb Lumber Co., Ltd., Toronto

STORE FRONT CONSTRUCTION

Braid & McCurdy, Winnipeg
 Canadian Ornamental Iron Co., Ltd., Toronto
 Canadian Store Front Co., Hamilton
 Consolidated Glass Co., Toronto
 Dartnell, Ltd., Montreal
 Dennis Wire & Iron Works, Ltd., London
 Easy Set Store Front Construction Co., Toronto
 Hobbs Mfg. Co., Ltd., Toronto
 Kawneer Mfg. Co., Toronto
 Mitchell, Robt., & Co., Ltd., Montreal
 O'Neil, Wm. N., & Co., Ltd., Vancouver
 Ormsby, A. B., Co., Ltd., Toronto
 Pedlar People, Ltd., Oshawa
 Zouri Drawn Metals Co., Chicago, Ill.

STOVES (Heating)

Clare Bros. & Co., Ltd., Preston
 McClary Mfg. Co., London
 Stewart, Jas., Mfg. Co., Ltd., Woodstock

STRUCTURAL STEEL

Canada Foundry Co., Toronto
 Canadian Bridge Co., Ltd., Walkerville
 Dominion Bridge Co., Ltd., Montreal
 Hamilton Bridge Co., Hamilton
 Gaudry, L. H., & Co., Ltd., Quebec
 Manitoba Bridge & Iron Works, Ltd., Winnipeg
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Structural Steel Co., Montreal

STUDDING (Metal)

Aikenhead Hardware Co., Toronto
 Manitoba Gypsum Co., Ltd., Winnipeg

Noble, Clarence W., Toronto
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Ormsby, A. B., Co., Ltd., Toronto
 Pedlar People, Ltd., Oshawa
 Steel & Radiation, Ltd., Toronto
 Trussed Concrete Steel Co. of Canada, Ltd., Walkerville
 Winnipeg Ceiling & Roofing Co., Ltd., Winnipeg

SURVEYING INSTRUMENTS

Aikenhead Hardware Co., Toronto
 Art Metropole, Toronto
 Dietzgen, Eugene, Co., Ltd., Toronto
 Keuffel & Esser Co., Hoboken, N.J.

SWITCHBOARDS & EQUIPMENT (Lighting & Power)

Crouse-Hinds & Co., Ltd., Toronto
 Monarch Electric Co., St. Lambert, Que.
 Northern Electric & Mfg. Co., Ltd., Montreal
 Siemens of Canada, Ltd., Montreal

SWITCHES (Electric)

Canada Foundry Co., Ltd., Toronto
 Canadian Tungsten Lamp Co., Ltd., Hamilton
 Crouse-Hinds Co., Ltd., Toronto
 Hill Electric Switch & fg. Co., Ltd., Montreal
 Northern Electric & Mfg. Co., Ltd., Montreal

SYPHON CLOSETS (Porcelain Enamelled)

B. O. T. Mfg. Co., Toronto
 Cluff Bros., Toronto
 Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

T**TABLETS (Memorial & Sign)**

Aikenhead Hardware Co., Toronto
 Booth, Geo., & Son, Toronto
 Dennis Wire & Iron Goods Co., London
 Estey Bros. Co., Montreal
 Hobbs Mfg. Co., Ltd., London
 Mitchell, Robt., Co., Ltd., Montreal
 O'Neil, Wm. N., Co., Ltd., Vancouver
 Richardson, J. E., & Co., Toronto

TANKS (Galvanized Iron)

Cluff Bros., Toronto
 Ormsby, A. B., Co., Ltd., Toronto
 Sicke Gas Co., Ltd., Toronto
 Winnipeg Ceiling & Roofing Co., Ltd., Winnipeg

TANKS (Oil or Gasoline)

Boving & Co. of Canada, Ltd., Toronto
 Bowser, S. F. Inc., Toronto
 Goldie & McCulloch Co., Galt
 Jenckes Machine Co., Sherbrooke, Que.
 Manitoba Bridge & Iron Works, Ltd., Winnipeg
 Waterous Engine Works Co., Brantford
 Wayne Oil Tank Co., Ltd., Toronto

TANKS (Porcelain Enamelled)

B. O. T. Mfg. Co., Ltd., Toronto
 Cluff Bros., Toronto
 Empire Mfg. Co., Ltd., London
 Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

TANKS (Water, Steel)

Boving & Co. of Canada, Ltd., Toronto
 Canada Foundry Co., Ltd., Toronto
 Cluff Bros., Toronto
 Dominion Bridge Co., Ltd., Montreal
 Dominion Radiator Co., Ltd., Toronto
 Empire Mfg. Co., Ltd., London
 Goldie & McCulloch, Ltd., Galt
 Gould, Shapley & Muir Co., Ltd., Brantford
 National Equipment Co., Ltd., Toronto
 Pease Foundry, Ltd., Toronto
 Polson Iron Works, Toronto
 Waterous Engine Works Co., Ltd., Brantford

TANKS (Water, Wood)

Cluff Bros., Toronto
Cushing Bros. Co., Ltd., Calgary
Rhodes-Curry Co., Ltd., Amherst

TANK TRESTLES

Canada Foundry Co., Ltd., Toronto
Canadian Bridge Co., Ltd., Walkerville
Dominion Bridge Co., Ltd., Montreal
Eastern Canada Steel & Iron Works, Ltd., Quebec

TAR & GRAVEL ROOFING

Carey, Phillip, Co., Toronto
Ormsby, A. B., Co., Ltd., Toronto
Winnipeg Ceiling & Roofing Co., Ltd., Winnipeg

TELEPHONES & TELEPHONE SYSTEMS

Canadian Independent Telephone Co., Ltd., Toronto
Northern Electric & Mfg. Co., Ltd., Montreal
Norton Telephone Co., Toronto
Stromberg-Carlson Telephone Co., Toronto

TENTS

Pike, W. E., Toronto
Smart-Woods, Ltd., Ottawa

TERRA COTTA (Architectural)

American Terra Cotta Co., Chicago
Atlantic Terra Cotta Co., New York
Black Building Supply Co., New York
Dartnell, Ltd., Montreal
Doulton & Co., Ltd., London, Eng.
Federal Terra Cotta Co., Chicago
Gibbs & Canning, Ltd., Tamworth, Eng.
Hankin, Francis, & Co., Montreal
Killackey, F. S. & Co., Toronto
Ludowici-Celabon Co., Chicago
New Jersey Terra Cotta Co., New York
New York Architectural Terra Cotta Co., New York
North Western Terra Cotta Co., Chicago
O'Neil, Wm. N., Co., Ltd., Vancouver
Siebert, Geo. E., Winnipeg
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
Waite-Fullerton Co., Ltd., Winnipeg

TERRA COTTA (Fireproof)

American Terra Cotta Co., Chicago
Dartnell, E. F. Ltd., Montreal
Don Valley Brick Works, Toronto
National Fireproofing Co., Canada, Ltd., Toronto
New Jersey Terra Cotta Co., New York
Siebert, Geo. E., Winnipeg
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
Sun Brick Co., Toronto
Waite-Fullerton Co., Ltd., Winnipeg

TERRA COTTA (Structural)

American Terra Cotta Co., Chicago
Atlantic Terra Cotta Co., New York City
Dartnell, Ltd., Montreal
Doulton & Co., Ltd., London, Eng.
Federal Terra Cotta Co., Chicago
Gibbs & Canning, Ltd., Tamworth, Eng.
Hankin, Francis, & Co., Montreal
Leeds Fireclay Co., Ltd., Leeds, Eng.
New Jersey Terra Cotta Co., New York City
New York Architectural Terra Cotta Co., New York
Northwestern Terra Cotta Co., Chicago
O'Neil, Wm. N., Co., Ltd., Vancouver
Siebert, Geo. E., Winnipeg
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
Waite-Fullerton Co., Ltd., Winnipeg

THERMOSTATS (All Kinds)

Canadian Powers Regulator Co., Toronto
Cluff Bros., Toronto
Johnson Temperature Regulating Co. of Canada, Ltd., Toronto

TILE (All Kinds)

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
Dominion Marble Co., Ltd., Montreal
Gaudry, L. H., & Co., Ltd., Quebec
Hankin, Francis, & Co., Montreal
Lautz-Dunham Co., Ltd., Toronto
Ludowici-Celadon Co., Chicago
Luxfer Prism Co., Ltd., Toronto
Missisquoi Marble Co., Ltd., Montreal
Mosaic Tile Co. of Zanesville, Ohio, New York
Smith Marble & Construction Co., Ltd., Montreal
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
Waite-Fullerton Co., Ltd., Winnipeg

TILES (Brick)

Braid & McCurdy, Winnipeg
Chance Bros. & Co., Ltd., near Birmingham, Eng.
Mosaic Tile Co., New York

TILE (Fireproofing)

Alabastine Co., Paris, Ltd., Paris
Crown Gypsum Co., Ltd., Lythmore
Dominion Gypsum Co., Ltd., Winnipeg
Manitoba Gypsum Co., Ltd., Winnipeg
United States Gypsum Co., Ltd., Chicago
Waite-Fullerton Co., Ltd., Winnipeg

TILES (Floor or Wall)

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
Bate, W. B., Co., Toronto
Chance Bros. & Co., Ltd., near Birmingham, Eng.
Dominion Marble Co., Ltd., Montreal
Doulton & Co., Ltd., London, Eng.
Gaudry, L. H., Co., Ltd., Quebec
Hocking Valley Fireclay Co., Nelsonville, Ohio
Lautz-Dunham Co., Toronto
Ludowici & Celabon Co., Chicago
Mosaic Tile Co. of Zanesville, O., New York
Northwestern Terra Cotta Co., Chicago, Ill.
O'Neil, Wm. N., Co., Ltd., Vancouver
Smith Marble & Construction Co., Ltd., Montreal
Waite-Fullerton Co., Ltd., Winnipeg

TILE (Floor or Walls, Ceramic)

Chance Bros. & Co., Ltd., near Birmingham, Eng.
Hankin, Francis, & Co., Montreal
Lautz-Dunham & Co., Toronto
Mosaic Tile Co. of Zanesville, O., New York

TILES (Floor or Wall, Rubber)

Chance Bros. & Co., Ltd., near Birmingham, Eng.
Consolidated Rubber Co., Montreal
Dominion Marble Co., Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Toronto
Gutta Percha & Rubber, Ltd., Toronto
Window Strip Co., Montreal

TILE (Marble)

Alsip Brick, Tile & Lumber Co., Ltd., Winnipeg
Cullen, E. G., Vancouver
Dominion Marble Co., Ltd., Montreal
Hoidge Marble Co., Ltd., Toronto
Lautz-Dunham Co., Ltd., Toronto
Missisquoi Marble Co., Ltd., Montreal
Mosaic Tile Co. of Zanesville, Ohio, New York
Smith Marble & Construction Co., Ltd., Montreal

TILES (Roofing)

Black Building Supply Co., Toronto
Chance Bros. & Co., Ltd., near Birmingham, Eng.
Dartnell, E. F., Ltd., Montreal
Ludowici-Celadon Co., Chicago

TILE ROOFING (Glass)

Canada Floors, Ltd., Ottawa
Toronto Plate Glass Importing Co., Ltd.,
Toronto

TILES (Welsh Quarry)

Alsip Brick, Tile & Lumber Co., Ltd.,
Winnipeg
Black Building Supply Co. Toronto
Dartnell, Ltd., Montreal
Dominion Marble Co., Ltd., Montreal
Ludowici-Celadon Co., Chicago
O'Neil, Wm. N., Co., Ltd., Vancouver
Smith Marble & Construction Co., Ltd.,
Montreal
Waite-Fullerton Co., Ltd., Winnipeg

**TIMBER PRESERVATION & PRESERVING
OUTFITS**

Carbolineum Wood Preserving Co., New
York
Grosche, Brun. & Co., New York
Northeastern Co., Boston
Shearer, Jas., & Co., Ltd., Montreal

**TOILET TABLES (Bathroom, Porcelain Ena-
melled)**

Cluff Bros., Toronto
Dominion Marble Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto

TRANSFORMERS

Canadian Fairbanks-Morse Co., Ltd.,
Montreal
Canadian General Electric Co., Ltd., To-
ronto
Canadian Westinghouse Co., Toronto
Crouse-Hinds & Co., Ltd., Toronto
Monarch Electric Co., St. Lambert, Que.
Northern Electric & Mfg. Co., Ltd., Mont-
real
Siemens Co. of Canada, Ltd., Montreal

TRAPS

Canadian Fairbanks-Morse Co., Ltd.,
Montreal
Cluff Bros., Toronto
Dennis Wire & Iron Works Co., Ltd., Lon-
don
Dunham, C. A., Co., Ltd., Toronto
Empire Mfg. Co., Ltd., London
Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto
Sheldons, Ltd., Galt
Warden, King Ltd. Montreal

TRAPS (Porcelain Enamelled)

B. O. T. Mfg. Co., Ltd., Toronto
Cluff Bros., Toronto
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto
Standard Ideal Co., Ltd., Port Hope
Standard Sanitary Co., Ltd., Toronto

TRIM (Wood)

Batts, Ltd., Toronto
Berlin Interior Hardwood Co., Ltd., Berlin
Burton & Baldwin Mfg. Co., Hamilton
Canada Lumber Co., Ltd., Toronto
Canadian Office & School Furniture Co.,
Preston
Cushing Bros. Co., Ltd., Calgary
Knight Bros. & Co., Ltd., Burk's Falls
Lickley, H. M., Ltd., Toronto
Rhodes-Curry Co., Ltd., Amherst
Rutherford & Son, Wm., Ltd., Montreal
Walker Bin & Store Fixture Co., Ltd.,
Berlin
Webb Lumber Co., Ltd., Toronto

TRUSSES (Roof)

Canada Foundry Co., Ltd., Toronto
Canadian Bridge Co., Ltd., Walkerville
Dominion Bridge Co., Ltd., Montreal
Eastern Canada Steel & Iron Works, Ltd.,
Quebec
Gaudry, L. H., & Co., Ltd., Quebec
Manitoba Bridge & Iron Works, Ltd.,
Winnipeg
Structural Steel Co., Montreal

TUBES (Boiler)

Goldie & McCulloch, Ltd., Galt
Manitoba Bridge & Iron Works, Winnipeg
Polson Iron Works, Ltd., Toronto
Waterous Engine Works Co., Ltd., Brant-
ford

TUBES (Brass, Bronze, Copper)

Mitchell, Robt., Co., Ltd., Montreal
Ormsby, A. B., Co., Ltd., Toronto
Winnipeg Ceiling & Roofing Co., Winni-
peg

TUBES (Brazed or Seamless)

Aikenhead Hardware Co., Toronto

TURNTABLES (Industrial)

Canada Foundry Co., Ltd., Toronto
Canadian Bridge Co., Ltd., Walkerville
Dominion Bridge Co., Ltd., Montreal

U

URINALS

Cluff Bros., Toronto
Empire Mfg. Co., Ltd., London
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto
Standard Ideal Co., Port Hope
Standard Sanitary Co., Ltd., Toronto

V

VACUUM CLEANERS

(See Cleaning, Mechanical)

VALVE BOXES

Canada Foundry Co., Ltd., Toronto
Dominion Radiator Co., Ltd., Toronto
Gaudry, L. H., & Co., Ltd., Quebec
Kerr Engine Co., Ltd., Walkerville
Mitchell, Robt., Co., Ltd., Montreal

VALVES

Boving & Co. of Canada, Ltd. Toronto
Canada Foundry Co., Ltd., Toronto
Canadian Fairbanks-Morse Co., Ltd.,
Montreal
Cluff Bros., Toronto
Dominion Radiator Co., Ltd., Toronto
Dunham, C. A., Co., Ltd., Toronto
Empire Mfg. Co., Ltd., Toronto
Gaudry, L. H., & Co., Ltd., Quebec
Goldie & McCulloch Co., Ltd., Galt
Johnson Temperature Regulating Co. of
Canada, Ltd., Toronto
Kerr Engine Co., Ltd., Walkerville
Mitchell, Robt., Co., Ltd., Montreal
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto
Pease Foundry Co., Ltd., Toronto
Sheldons, Ltd., Galt
Steel & Radiation, Ltd., Toronto

VALVES (Back Pressure)

Canadian Fairbanks-Morse Co., Ltd.,
Montreal
Dominion Radiator Co., Ltd., Toronto
Empire Mfg. Co., Ltd., London
Goldie & McCulloch, Ltd., Galt
Kerr Engine Co., Ltd., Walkerville
Mitchell, Robt., Co., Ltd., Montreal
Sheldons, Ltd., Galt
Steel & Radiation, Ltd., Toronto

VALVES (Radiator)

Dunham, C. A., & Co., Ltd., Toronto
Jenkins Bros., Ltd., Montreal
Johnson Temperature Co., Toronto
Lunkenheimer Co., Cincinnati
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto
Ohio Brass Co., Mansfield

VALVES (Reducing)

Canadian Powers Regulator Co., Ltd., To-
ronto
Johnson Temperature Regulating Co. of
Canada, Ltd., Toronto
Liberty Mfg. Co., Pittsburgh
Morrison, Jas., Brass Mfg. Co., Ltd., To-
ronto

VALVES (Reducing)—Continued

Mueller, H. Mfg. Co., Ltd., Sarnia
Ohio Brass Co., Mansfield
Watson & McDaniel Co., Philadelphia

VALVES (Vacuum)

Acme Vacuum Cleaner Co., Montreal
Darling Bros., Montreal
Dunham, C. A., Co., Ltd., Toronto
Robertson, Jas. B., Co., Toronto
Smart-Turner Machine Co., Hamilton
Taylor-Forbes Co., Guelph
Zimmer Vacuum Machine Co., Toronto

VARNISHES & FINISHES

Alkenhead Hardware Co., Toronto
Alabastine Co., Ltd., Paris
Ault & Wiborg Co., Toronto
Bate, W. B., Co., Toronto
Berry Bros., Walkerville
Brandram-Henderson Co., Montreal
Colonial Varnish Co., Ltd., Toronto
Dartnell, E. F., Ltd., Montreal
Dods, P. D., & Co., Ltd., Montreal
Dougall Varnish Co., Ltd., Montreal
Electric Paint & Varnish Co., Cleveland
Glidden Varnish Co., Toronto
Harland, Wm., & Son, Toronto
Holland Varnish Co., Montreal
Imperial Varnish & Color Co., Ltd., Toronto
International Varnish Co., Toronto
Jamieson, R. C., Co., Ltd., Montreal
Langmuir, Jas., & Co., Ltd., Toronto
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Moore, Benj., Co., Ltd., Toronto
Patton Paint Co., Newark
Pinchin, Johnson Co. (Canada), Ltd., Toronto
Pratt & Lambert, Bridgeburg
Ramsay, A., & Son Co., Ltd., Montreal
R. I. W. Damp Resisting Paint Co., Toronto
Sanderson, Percy & Co., Ltd., Toronto
Sherwin-Williams Co., Ltd., Montreal

VAULT LIGHTS

Consolidated Plate Glass Co., Ltd., Toronto
Gaudry, L. H., & Co., Ltd., Quebec
Hobbs Mfg. Co., Ltd., London
Jefferson Glass Co., Ltd., Toronto
Luxfer Prism Co., Toronto
Watson, Jno., Son, of Montreal, Ltd., Montreal

VAULTS (Safe Deposit)

Ahern Safe Co., Ltd., Montreal
Manitoba Bridge & Iron Works, Ltd., Winnipeg
Pilkington Bros., Ltd., Montreal
Canadian Fairbanks-Morse Co., Ltd., Montreal
Dominion Safe & Vault Co., Ltd., Farnham, Que.
Ford & Featherstone, Ltd., Hamilton
Goldie & McCulloch, Ltd., Galt
O'Neil, Wm. N., Co., Ltd., Vancouver
Taylor, J. & J., Ltd., Toronto

VENETIAN AWNINGS

Watson, Ltd., Bradford
Wilson, Jas. G., Mfg. Co., New York City

VENTILATING CONTRACTORS

Sheldons, Ltd., Galt

VENTILATING SYSTEMS

Canadian Sirroco Co., Windsor
Douglas Bros., Ltd., Toronto
Gardner & Gaskell, Montreal
Garth & Co., Montreal
Goldie & McCulloch Co., Galt
Johnson Temperature Regulating Co. of Canada, Toronto
Sheldons, Ltd., Galt

VENTILATOR FRAMES

Hobbs Mfg. Co., Ltd., London
Ormsby, A. B., Co., Ltd., Toronto

VENTILATORS

Clare Bros. & Co., Ltd., Preston
Douglas Bros., Toronto
Ormsby, A. B., Co., Ltd., Toronto
Pearson, Geo. D., & Co., Montreal
Pedlar People, Ltd., Oshawa
Sheldons, Ltd., Galt
Tuttle & Bailey Mfg. Co. of Canada, Ltd., Bridgeburg

VERANDAH COLUMNS (Artificial Stone)

Canadian Art Stone Co., Ltd., Toronto
Corinthian Stone Co., Guelph
Monarch Stone Co., Ltd., Toronto
Roman Stone Co., Ltd., Toronto
Toronto Ornamental Stone Co., Toronto

VERANDAH COLUMNS (Marble)

Dominion Marble Co., Ltd., Montreal
Hoidge Marble Co., Ltd., Toronto
Lautz-Dunham & Co., Toronto
Missisquoi Marble Co., Ltd., Montreal
Smith Marble & Construction Co., Ltd., Montreal

VERANDAH COLUMNS (Wood)

Batts, Ltd., Toronto
Canada Lumber Co., Ltd., Toronto
Cushing Bros. Co., Ltd., Calgary
O'Neil, Wm. N., Co., Ltd., Vancouver
Rhodes-Curry Co., Ltd., Amherst
Rutherford & Sons, Montreal

W

WAINSCOTTING (Plaster)

Canada Floors, Ltd., Ottawa
Dancy, R. C., Toronto
Hynes, Wm. J., Toronto
United States Gypsum Co., Chicago

WAINSCOTTING (Rubber & Tile)

Dominion Marble Co., Ltd., Montreal
Lautz-Dunham Co., Ltd., Toronto
Smith Marble & Construction Co., Ltd., Montreal

WALL BOARD

Beaver Board Co., Buffalo, N.Y.
Bird, F. W., & Son, East Walpole, Mass.
Bishopric Wall Board Co., Ottawa
Laidlaw, R., Co., Ltd., Toronto

WALL COVERING

Alabastine Co., Paris, Ltd., Paris
Bate, W. B., Co., Toronto
Electric Paint & Varnish Co., Cleveland
Glidden Varnish Co., Toronto
International Varnish Co., Ltd., Toronto
Lowe Bros., Ltd., Toronto
Martin-Senour Co., Ltd., Montreal
Moore, Benj., & Co., Toronto
Pedlar People, Ltd., Oshawa
Randall Bros., London, Eng.
Sturgeons, Ltd., Toronto

WALL PLATES

Duplex Hanger Co., Cleveland
Van Dorn Mfg. Co., Cleveland

WALL SAFES

(See Safes, Wall)

WALL TIES

Duplex Hanger Co., Cleveland
O'Neil, Wm. N., Co., Ltd., Vancouver
Steel & Radiation, Toronto
Stinson-Reeb Builders' Supply Co., Ltd., Montreal
Van Dorn Mfg. Co., Cleveland

WARDROBES

Berlin Interior Hardwood Co., Ltd., Berlin
Burton & Baldwin Mfg. Co., Ltd., Hamilton
Canadian Office & School Furniture Co., Ltd., Preston
Cushing Bros. Co., Ltd., Calgary
Knight Bros. Co., Ltd., Burk's Falls
Walker Bin & Store Fixture Co., Ltd., Berlin

WARDROBES (Metal)

Wilson, Jas. G., Mfg. Co., New York

WASH SINKS

(See Sinks)

WATER CLOSET COMBINATIONS

B. O. T. Mfg. Co., Ltd., Toronto

Cluff Bros., Toronto

Empire Mfg. Co., Ltd., London

Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

WATER CLOSETS (Porcelain Enamelled)

B. O. T. Mfg. Co., Toronto

Canadian H. W. Johns-Manville Co., Ltd., Toronto

Cluff Bros., Toronto

Empire Mfg. Co., Ltd., London

Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

Robertson, Jas., Co., Ltd., Toronto

WATER GAUGES & COLUMNS

Canadian Fairbanks-Morse Co., Ltd., Montreal

Dominion Radiator Co., Ltd., Toronto

Mitchell, Robt., Co., Ltd., Montreal

Morrison, Jas., Brass Mfg. Co., Ltd., Toronto

WATER METERS

Canadian Fairbanks-Morse Co., Ltd., Montreal

Empire Mfg. Co., Ltd., London

WATER WHEELS

Boving & Co. of Canada, Ltd., Toronto

Lister, R. A., & Co., Toronto

WATERPROOF BUILDING PAPERS

(See Paper, Building, Insulating & Sheathing)

WATERPROOFING & DAMP RESISTING PAINTS & COMPOUNDS

Acorn Refining Co., Cleveland

Brantford Roofing Co., Ltd., Brantford

Cabot, Samuel, Inc., Boston

Canadian H. W. Johns-Manville Co., Ltd., Toronto

Canadian Supply & Contracting Co., Toronto

Carey, Phillip, Co., Toronto

Dartnell, E. F., Ltd., Montreal

Dominion Paint Works, Ltd., Walkerville

Electric Paint & Varnish Co., Cleveland

Glidden Varnish Co., Toronto

Harland, Wm., & Son, Toronto

Hankin, Francis, & Co., Ltd., Montreal

Hercules Waterproofing Co., Buffalo, N.Y.

Integral Waterproofing Co., New York

International Varnish Co., Ltd., Toronto

Jamieson, R. C., & Co., Ltd., Montreal

Lowe Bros., Ltd., Toronto

Martin-Senour Co., Ltd., Montreal

Moore, Benj., & Co., Ltd., Toronto

Patton Paint Co., Newark, N.J.

Pinchin, Johnson Co. (Canada), Ltd., Toronto

R. I. W. Damp Resisting Paint Co., Toronto

Ceresit Waterproofing Co., Chicago

Stinson-Reeb Builders' Supply Co., Ltd., Montreal

Sturgeons, Ltd., Toronto

Thornhill, W. H., Co., Winnipeg

Trussed Concrete Steel Co. of Canada, Ltd., Walkerville

Waite-Fullerton Co., Ltd., Winnipeg

WATERPROOFING (Cement)

Ault & Wiborg Co., Ltd., Toronto

Canadian Bitumatic Enamels Co., Toronto

Hercules Waterproofing Co., Buffalo, N.Y.

Integral Waterproofing Co., New York

Stinson-Reeb Builders' Supply Co., Montreal

WATERPROOF INSULATED PAPERS

(See Paper, Building, Insulated & Sheathing)

WATERWORKS SUPPLIES

Bell Filtration Co. of Canada, Ltd., Toronto

Canada Foundry Co., Ltd., Toronto

Canadian Fairbanks-Morse Co., Ltd., Montreal

Drummond-McCall Co., Ltd., Montreal

Empire Mfg. Co., Ltd., London

Gaudry, L. H., & Co., Ltd., Quebec

Ingles, Jno. Co., Toronto

Kerr Engine Co., Walkerville

Mitchell, Robt., Co., Ltd., Montreal

Mussens, Ltd., Montreal

Robertson, Jas. B., Co., Toronto

Waterous Engine Co., Ltd., Brantford

WAX

Ronuk, Ltd., Toronto

Bate, W. B., & Co., Toronto

WEATHER STRIPS

Aikenhead Hardware Co., Toronto

Canada Acme Metal Weatherstrip Co., Toronto

Canadian Consolidated Rubber Co., Montreal

Chamberlain Metal Weather Strip Co., Ltd., Toronto

Crown Metal Weatherstrip Co., Toronto

Golden All Metal Weatherstrip Co., Toronto

Malott Weatherstrip Co., Toronto

O'Neil, Wm. N., Co., Ltd., Vancouver

Ormsby, A. B., Co., Ltd., Toronto

Pease Co., Ltd., Hamilton

Watson, Ltd., Bradford

Windowstrip Co., Montreal

WEATHER VANES

Canadian Ornamental Iron Co., Ltd., Toronto

Dennis Wire & Iron Works, London

Meadows, Geo. B., Toronto

Pedlar People, Ltd., Oshawa

Roofers' Supply Co., Ltd., Toronto

WHEELBARROWS

Aikenhead Hardware Co., Toronto

Mussens, Ltd., Montreal

Wettlaufer Bros., Toronto

WHITE LEAD

(See Lead, Red & White)

WINDMILLS

Goold, Shapley & Muir Co., Ltd., Brantford

WINDOW CASEMENTS

Aikenhead Hardware Co., Toronto

Dennis Wire & Iron Works, London

Dominion Architectural Iron Works, Ltd.

O'Neil, Wm. N., Co., Ltd., Vancouver

Ormsby, A. B., Co., Ltd., Toronto

WINDOW FRAMES (Cast Iron)

Canada Foundry Co., Ltd., Toronto

Canadian Ornamental Iron Co., Ltd., Toronto

Dennis Wire & Iron Works Co., Ltd., London

Dominion Architectural Iron Works, Ltd., Montreal

Estey Bros. Co., Montreal

Gaudry, L. H., & Co., Ltd., Quebec

Meadows, Geo. B., Toronto

O'Neil, Wm. N., Co., Ltd., Vancouver

Watson, John & Son of Montreal, Ltd., Montreal

WINDOW LETTERS (All Kinds)

Booth, Geo., & Son, Toronto

Richardson, J. E., & Co. Toronto

WINDOWS (Metal)

Douglas Bros., Ltd., Toronto

Gaudry, L. H., & Co., Ltd., Quebec

Hope, Henry, & Son, Ltd., Toronto

Ormsby, A. B., & Co., Ltd., Toronto

Pedlar People, Ltd., Oshawa

Steel & Radiation, Ltd., Toronto

Stinson-Reeb Builders' Supply Co., Ltd., Montreal

WINDOWS (Metal)—Continued

Trussed Concrete Steel Co. of Canada,
Ltd., Walkerville
Winnipeg Ceiling & Roofing Co., Ltd.,
Winnipeg

WIRE & CABLE (Electric)

Canada Foundry Co., Ltd., Toronto
Canada Wire & Cable, Ltd., Toronto
Imperial Wire & Cable Co., Ltd., Montreal
Keiths, Ltd., Toronto
Northern Electric & Mfg. Co., Ltd., Mont-
real
Phillips, Eugene, Electrical Works, Mont-
real
Standard Underground Cable Co. of Can-
ada, Ltd., Montreal
Wire & Cable Co., Ltd., Montreal

WIRE (Brass, Bronze, Copper)

Aikenhead Hardware Co., Toronto
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London
Dominion Ornamental Iron Co., Toronto
Dyer Fence & Supply Co., Toronto
Meadows, Geo. B., Toronto

WIRE CLOTH

Aikenhead Hardware Co., Toronto
Canada Wire & Iron Goods Co., Hamilton
Goldie & McCulloch, Galt
Greening, B., Wire Co., Ltd., Hamilton
Meadows, Geo. B., Toronto
Pedlar People, Ltd., Oshawa
Watson, Ltd., Bradford

WIRE FENCE

Canadian Ornamental Iron Co., Toronto
Dennis Wire & Iron Co., London
Dominion Ornamental Iron Co., Toronto
Dyer Fence & Supply Co., Toronto
Gaudry, L. H., & Co., Ltd., Quebec

Meadows, Geo. B., Toronto

Page Wire Fence Co., Ltd., Walkerville
Watson, Jno., & Son of Montreal, Ltd.,
Montreal

WIRE GLASS

Consolidated Plate Glass Co., Ltd., Toron-
to

Cushing Bros., Co., Ltd., Calgary
Gaudry, L. H., & Co., Ltd., Quebec

Hobbs Mfg. Co., Ltd., London

Montreal Paint & Glass Co., Montreal

O'Neil, Wm. N., Co., Vancouver

Ormsby, A. B., Co., Ltd., Toronto

Pilkington Bros., Ltd., Montreal

Tompson, B. & S. H., & Co., Ltd., Mont-
real

Toronto Plate Glass Importing Co., Ltd.,
Toronto

WOOD FIBRE WALL PLASTER

Alabastine Co., Paris, Ltd., Paris

Crown Gypsum Co., Ltd., Lythmore

Dominion Gypsum Co., Ltd., Winnipeg

Manitoba Gypsum Co., Ltd., Winnipeg

Stinson-Reeb Builders' Supply Co., Ltd.,
Montreal

United States Gypsum Co., Chicago

WOODWORKING MACHINERY

Goldie & McCulloch Co., Ltd., Galt

Miller Bros. & Sons, Ltd., Montreal

WROUGHT IRON

(See Iron Work, Architectural or Orna-
mental)

Z

ZINC

O'Neil, Wm. N., Co., Ltd., Vancouver
Pedlar People, Ltd., Oshawa



INFORMATION BUREAU

Demand

That this is the age of enquiry; that information is wanted—more information—called for through an insistent public demand for greater efficiency, is recognised by the members of your profession as well as other logically organized people.

Service

Realizing this need we have established, in conjunction with this publication, a service designed to meet the needs of your and kindred professions.

Scope

Through the **Referendex** Information Bureau we are prepared to supply any information you may need regarding building construction or the material, appliances and equipment entering into any class of structure.

Should you desire further information regarding any advertisers' product, this department of our organization will fill your needs.

No Charge

This service is, like **Referendex**, free to those who influence or control the selection of building trade products.

We have on file detailed information covering hundreds of materials and appliances necessary in building construction, which is at the disposal of **Referendex** users.

If you do not find it in **Referendex**, write us.

GENERAL SPECIFICATION CLAUSES

THE FOLLOWING ARE A FEW CLAUSES WHICH MAY BE INCORPORATED IN ANY SPECIFICATION.

DEFINITION OF TERMS.

Define clearly: Owner, owner's representative, architect, architect's representative, contractor, sub-contractor, engineer, inspector, or any other person or persons that will be connected with the work.

CONTRACTOR'S UNDERTAKING.

The contractor undertakes to furnish all material, labor, tools, scaffolding, and appliances necessary to the completion of the work in accord with the evident intention of the contract. He further undertakes to provide and do all these things and work, as the case may be, for the amount stated in his tender, and clearly understands that no further remuneration can be claimed for the fulfilment of the work set forth in the plans.

PLANS AND SPECIFICATIONS.

The architect, as author of these plans and specifications, reserves the right to interpret them. All questions of conflicting or erroneous statement, whether of a graphical or written character, must be referred to him. And his interpretation and decision will be final. It is understood that his decisions shall conform with the true intent of the contract, and therefore errors and omissions in plans or specifications will not justify the contractor in only a partial fulfilment of the work. He must also hold himself responsible for all work executed according to details prepared by himself.

CHARACTER OF WORK.

The contractor agrees to provide a quality of material, tools, workmanship, or appliances customarily known in his trade as the "best." He further agrees to remove all defective work or material and replace same at his own expense before a final approval is granted. If such work or material is not removed from the premises within days he understands that the owner may do this himself and deduct the cost from the amount due the contractor.

INSPECTION.

The contractor agrees to allow full inspection of all work or materials at all times by the architect. No material will be permitted in the work which has not had the approval of the architect or inspector. Approval of defective work or material through oversight

or failure to point out faults during construction will not relieve the contractor of his obligation to complete the work in a fully satisfactory manner.

CONDUCT OF WORK.

The contractor shall lay out his own work (unless otherwise directed by the architect, who shall have complete control of all operations), and shall be responsible for its fitting to place. He shall keep a competent foreman on the work, who shall be qualified to act for him in his absence, and to receive instructions from the architect. The contractor also agrees to remove any employee whose presence is objectionable to the architect for any reason.

The contractor agrees to properly protect his work at all times, and also the building and work of other contractors from any damage that might result from his operations. Also to reasonably insure the safety of his employees, other workmen in the building, and the public. Also to protect the owner from damage suits originating from personal injuries received and chargeable to his negligence; also from law actions resulting from the use of patented articles furnished by the contractor; or from any lien or liens arising because of material or labor supplied by him. Building to be insured by contractors during erection.

ALTERATIONS.

The architect may at any time make such minor alterations in the plans as may seem to him to be desirable. Such alterations will be made in red ink and signed by the contractor and architect. When alterations do not exceed per cent. of the contract price either one way or the other, they are to be executed without extra remuneration, or reduction in the contract price. The architect may grant the contractor such extra remuneration as seems to him to be reasonable for extra work arising from minor alterations; also he has the right to withhold from the contract price such an amount as seems to him to be just for any work of which the contractor shall be relieved. (It should be clearly stated to what extent alterations may be carried. If alterations exceed per cent. of the amount involved the contractor agrees to enter into a supplementary or new contract.)

EXTRAS.

Should a clear case for extras be established, the architect should protect his client, by inserting in his specification clauses covering the matter. Extras should be done on the cost plus a percentage basis, with the architect fully informed of cost by "time sheets" and invoices. The contractor should understand that assent to alterations by the architect does not constitute sanction of a claim for extras.

EXTENT OF THE WORK.

Enumerate the various classes of work included in the contract and specify the extent of each.

Mention any portion of the work to be done by the owner or another contractor, or any material to be supplied by these parties.

A statement of quantities is desirable, where practical.

DRAWINGS, DIMENSIONS, ETC.

The accompanying plans and details, No. _____ to _____, inclusive, cover the work undertaken by the contractor. The contractor must satisfy himself concerning the accuracy of dimensions and also must see that all parts of the building concerning him are in a satisfactory condition, before proceeding with his work. The contractor shall make all necessary excavations and back-fill same to the satisfaction of the architect. He shall be responsible for all cuttings of wood-work, brick-work, or cement-work, or any cutting found necessary in fitting his materials to place, either within or without the building, said cutting to be done to the satisfaction of the architect.

Estimating Frame and Brick Houses, Fred T. Hodgson. David Williams & Co., New York.

Practical System for writing Specifications for building, W. F. Bower. Wm. T. Comstock & Co., New York.

EUGENE DIETZGEN CO. LTD.

TORONTO - ONT.

AGENTS:

Quebec	Edmonton	Ottawa	Port Arthur
J. A. McClure	The Douglas Co.	Capital Office Supply Co.	S. M. Lowery
Winnipeg			Montreal
Strain's Limited	MANUFACTURERS	Foster, Brown Co. Ltd.	

OF DRAWING MATERIALS AND SURVEYING INSTRUMENTS

To enumerate the extensive lines manufactured by the Eugene Dietzgen Co. in Surveying, Mathematical, Drawing and Scientific Instruments, Materials and Supplies, would be largely a repetition in enumerating over 7,000 articles, which we list and illustrate in our General Catalogue, copy of which will be sent to anyone of the Architectural or Engineering profession, delivery prepaid and at no charge.

Our Catalogue covers our complete lines but we call attention to a few of our special numbers, as follows:

The "Beck" File The most convenient and economical device for filing drawings and blue-prints.

Advantages

1. Drawings can be filed flat thus preserving their original attractiveness.
2. Drawings can be systematically filed and simultaneously indexed permitting of immediate location without handling drawings not required.
3. Drawings can be classified allowing the review of a complete subject or a single unit without disturbing the established arrangement.

These files are manufactured in single files or of multiple assembly.

Transits The precision required in scientific instruments is thoroughly appreciated and accurately carried out in our manufacture of Transits, Levels, Mathematical Instruments, Slide Rules, etc.

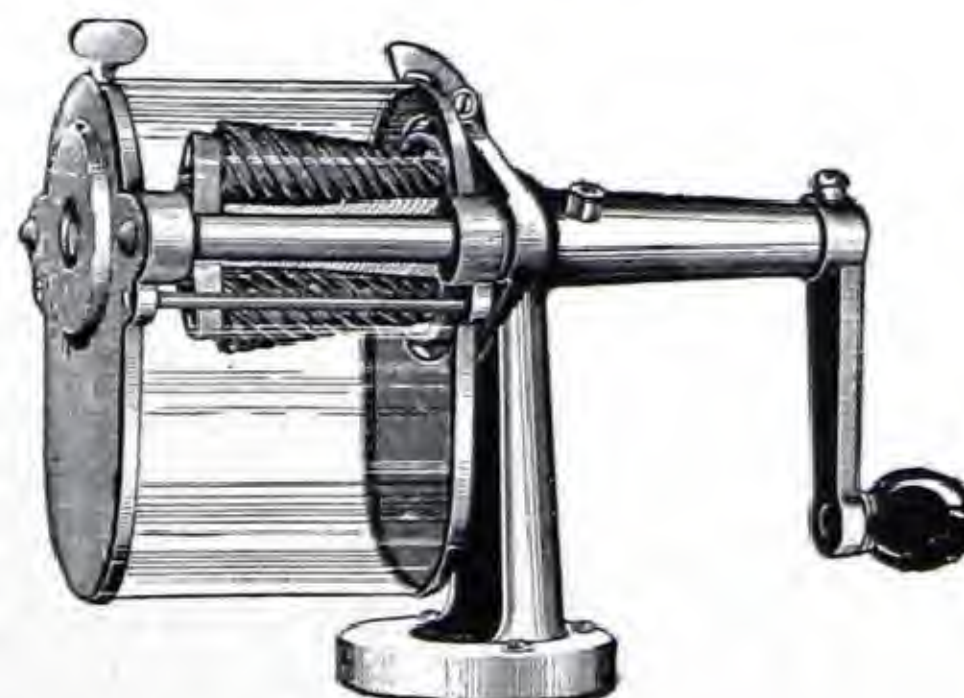
Pencil Sharpener The Boston Draughtsman's Model Pencil Sharpener is especially designed for drawing room use, because it will sharpen any pencil, giving an extra ($\frac{1}{4}$ in.) length of lead. It will cease to sharpen after this length is secured. Gives an unfinished point so that it can be finished to any desired point by the usual sandpad or file.



The Beck File



Transit



Satisfaction guaranteed by one week trial use.

EUGENE DIETZGEN CO., LTD.

TORONTO

European: NUREMBERG

Manufactories
American: CHICAGO

Canadian: TORONTO

Blue Printing

Including the "Paragon" Blue Printer and Paragon Mechanical Dryer, we operate a number of different styles of equipment, maintaining the advantage of handling each tracing to give the best results.

City maps and fine drawings by our Vacuum process give absolute delineation of every detail.

City Orders. Blue Prints in one hour. Delivered Guaranteed in 100 minutes. Country Orders given prompt attention.



Paragon Printing Machine

Dietzgen Economy Box

Is one of our recent numbers in the manufacture of special drawing room equipments. The Economy Box is used for storing Blueprint, Drawing and Tracing papers in rolls. Same can be drawn from the box in any given length and simultaneously measured.



Dietzgen Economy Box

Mathe- matical Instruments

Our manufacture of this line includes instruments of a large variety of designs and different qualities, the highest grade being recognized as the established standard of Drawing Instruments, to which other instruments are measured in comparison. Each grade of Mathematical Instruments manufactured by us is catalogued with a key letter and each instrument is stamped with the corresponding letter at the factory, as a guarantee of the exact quality represented. This eliminates the possible confusion or substitution which might occur, and gives full protection to the purchaser or draughtsman in the selection of any grade of instrument desired.



Our experience in the manufacture of the requirements for the Scientific and Drafting Profession, with conscientious effort to produce instruments of the highest grade and materials of the best quality, has met with a hearty response from all those desiring Instruments and Materials that possess more than the usual significance of merit.

From all those interested in our lines of manufacture we respectfully solicit their inquiries and correspondence.

FOUNDATIONS AND EXCAVATIONS

FOUNDATIONS ON DIFFERENT SOILS.

Rock—Good foundation; if not level, should be made so with stone cemented or concrete.

Gravel—The best foundation.

Sand—Good foundation, if dry, but always in danger of being washed away, such as by leaky drains, pumping operations connected with deep foundations even at a great distance, or any disturbance of the water level, natural or artificial.

Clay—Treacherous and damp. Make deep foundations.

Hard Overlying Soft Ground—Sink into it as little as possible, taking care that the pressure per unit of area is not greater than what the firm layer will bear.

Soft Ground Overlying Hard—Sink to depth of hard ground if possible by means of piles, wells of masonry, etc. If soft ground be of indefinite depth the platform must be supported by friction against the sides, and therefore must be of considerable thickness.

Never trust made ground to support weight even if it has been lying undisturbed for years.

*Prof. Ira O. Baker, discussing the bearing power of soils, says in part:

The ultimate crushing strength of stone is 150 tons per square foot for the softest and 2,000 tons per square foot for the hardest. The safe bearing power for rock is not less than 1/10 of crushing strength, hence the safe bearing power of stone is not less than 18 tons per square foot for the softest and 180 for the strongest.

In practice it scarcely ever occurs that rock is loaded with full amount of weight which it can hold.

Compact gravel or clean sand, in beds of considerable thickness, protected from being carried away by water, may be loaded with 8 to 10 tons per square foot with safety. Fine sand well cemented with clay and compacted, if protected from water, will safely carry 4 to 6 tons per square foot.

SAFE BEARING POWER OF SOILS.

Kind of Material	Safe bearing Power in Tons per sq. ft.	
	Min.	Max.
Rock—the hardest—in thick layers, in native bed.....	200	—
Rock, equal to best ashlar masonry	25	30
Rock, equal to best brick masonry.	15	20
Rock, equal to poor brick masonry.	5	10
Clay, in thick beds, always dry...		
Clay, in thick beds, moderately dry	4	6
Clay, soft.	1	2
Gravel and coarse sand, well cemented.	8	10
Sand, dry, compact, well cemented.	4	6
Sand, clean, dry.....	2	4
Quicksand, alluvial soils, etc.....	0.5	1

*A Treatise on Masonry Construction.

USEFUL DATA.

An ordinary one-horse cart 6 feet long by 3½ feet wide and 2½ feet deep will hold 45 cubic feet, or 1 2/3 cubic yards.

A regular builder's cart will hold 1 cubic yard.

A tip-wagon will hold, when heaped, 3 cubic yards.

A large wheelbarrow will hold 1/10 cubic yard.

A small wheelbarrow will hold 1/12 cubic yard.

A basket holds a bushel, or 1/21 cubic yard.

50 barrow loads make a good wagon load.

A stone wagon will carry from 2½ to 6 tons.

A double load of earth equals about 56 cubic feet.

A single load equals some 27 or 28 cubic feet.

A single, generally, is about 1 cubic yard.

A single, generally, is about 1 ton of stone, brick, etc.

500 bricks make a single load.

400 pressed bricks make a single load.

1,000 plain roofing tile make a single load.

1,000 slates, counters, make a single load.

1,000 feet dressed lumber make a single load.

50 cubic feet of timber make a single load.

1 cubic yard of mixed mortar makes a single load.

16 bushels of lime make a single load.

Earth in excavations weighs about as follows:—

1 cubic yard of common earth, 2,400 pounds.

1 cubic yard of top-soil earth, 2,000 pounds.

1 cubic yard of clay earth, 2,700 pounds.

1 cubic yard dry sand earth, 2,700 pounds.

1 cubic yard wet sand earth, 3,000 pounds.

1 cubic yard of sandy loam earth, 2,400 pounds.

1 cubic yard of mud earth, 2,500 pounds.

1 cubic yard of gravel earth, 3,000 pounds.

1 cubic foot of cement concrete, 6 broken stones, 1 sand, 1 cement, weighs 130 pounds.

1 cubic foot of concrete, 6 broken bricks, 1 sand, and 1 cement, weighs 120 pounds.

1 cubic foot of concrete, 6 broken ballast, 1 sand, and 1 cement, weighs 140 pounds.

A good laborer will dig and throw into a barrow in a day of ten hours:—

In common ground, from 8 to 10 cubic yards

In stiff clay or firm gravel, from 5 to 6 cubic yards.

In hard ground (picking required), from 3 to 5 cubic yards.

In excavating, a vertical throw is taken at 6 feet, and when a trench exceeds that depth, stages must be provided. In practice, stages are usually set at somewhat closer intervals.

A 10-ton steam shovel, fitted with a 1½-yard cube digging bucket, will excavate and deliver into wagons from 800 to 1,000 cubic yards per day of 10 working hours, according to the nature of the ground.

SPECIFICATION CAUSES RELATING TO FOUNDATIONS, ETC.

TERMS.

The term "foundations" in these specifications shall mean the base, built to grade or datum, upon which the superstructure rests. The term "footings" will be understood to mean the spread course at base of foundations.

DUTIES OF CONTRACTOR.

It shall be the duty of this contractor under the foundation contract to employ a competent surveyor to set out levels; inspect, clear, protect from damage from or to persons and property; secure and pay for building, water, and other necessary permits; remove, pile, store, or dispose of waste material in clearing site and excavation, and have general charge of preparation of site. He shall build enclosure, provided for by building law, of matched boards, convenient battened doors, with suitable locks, temporary sidewalk, etc. Lights at night, and all other necessary details will be provided as part of this contract not otherwise provided for in plans. Excavation shall be according to basement plan and architect's direction, and must be inspected and approved by him before footings are commenced. Sod and top soil, trees, obstructions, excavation materials are to be removed. Waste water provided for by trenches or pumping, and all drains under or through walls for service to be provided. Sides of excavation, shoring, and underpinning material to be provided as part of this contract.

OLD BUILDINGS.

Before razing operations are commenced a survey of the premises in company with the architect must be made and proper means for removal and stacking of material arranged. Shoring for adjacent buildings, chutes for removal of debris from upper storeys to be provided. Cut off and remove electric wires; cut off and tightly plug outside of foundation line, all water, sewer, and gas pipes. Clean and use good material. Old material to be piled and stored at direction of architect. Cesspools or wells to be cleaned and filled with fresh earth; impregnated soil removed, according to architect's direction.

EXCAVATION.

Shall be according to basement and foundation plans, and will extend at least twelve inches beyond outside wall line. Excavations for all trades, including sewer, water, gas, cesspools, etc., as shown on foundation plans, shall be made by this contractor, in a manner satisfactory to the architect, and the proper installation of these accessories.

BORINGS.

A two, four, six-inch augur shall be used to make test borings. Two holes for each column footing, not more than five feet apart for walls, and not less than six to twelve feet

deep, unless when to hardpan or rock. Rough grading and complete clearing away of waste material and inspection by architect is required before footings are commenced.

FOOTINGS.

Shall be laid on natural bed, shall be of a durable, strong quality, of dimension stone, full width of footing, not less than six inches each side of foundation wall or column, firmly settled and levelled, or two stones one-half width meeting in centre. Concrete of 2-5-9 mix (two parts cement, five parts sand, nine parts broken stone), standard brand cement, approved or specified by architect. Well mixed, laid carefully.

Concrete for cement foundations must not be dumped from a height greater than four feet. Each layer levelled off, tamped with twenty-pound wooden hammer. A one-half inch coat of cement, waterproofed with approved waterproofing compound, must be applied to outside surface of concrete foundations up to grade.

BROKEN STONE.

Shall be well bedded on natural bed, trench filled to within two feet of grade. Each course rammed, layer of straw, then broken stone to grade.

BRICK.

A good quality of hard-burned brick, approved or specified by architect, shall be used for all foundations. Bottom course bedded in cement mortar spread over carefully levelled bottom of trench. First course shall be double, other courses single, and outside courses all headers. Courses projecting not more than one-fourth dimension of brick, laid in cement, hydraulic lime, mortar, inside joints thoroughly grouted. Build all walls, dwarf walls, and piers in cellars, foundations for chimneys, and all walls for outside cellarway doors, piers for piazzas, porches, areas for cellar windows, areas for front and rear of building, and such street walls as shown on plans and sections, all laid with rubble stone, in good mortar. All walls where they come in contact with the ground must be well cemented on the outside, inch thick. All proper holes left in walls for drains, gas or water pipes, as directed and shown on plans or sections. Do all necessary repaving where disturbed by mason.

MORTAR.

Mortar for stone and brick work in these foundations shall be cement mortar, mixed one to three. All foundations must be plastered on outside surface to grade with one-half inch coat of cement mortar.

ENGINE AND BOILER BEDS, ETC.

The engine bed, as shown on foundation plan, must be built on natural bed, in stock brick work laid in carefully levelled and tamped cement, all holding down bolts built

in, stone cover, supplied by stone contractor set. Build foundations for boilers, according to detail drawings and foundation plan of stock brick, cement mortar. Sides of fire pit, bridge walls, and to feet up flue to be lined with fire brick, set in fire clay. Blow-off pit to be feet by

feet, built of concrete, one, two, three mix. Walls and hollow not less than nine inches thick, finished smooth and watertight, with surfacing of one-half inch of cement and standard waterproofing compound. A six-inch stone flag, rebated for metal cover furnished by stone contractor, will be placed on top.

PILE FOUNDATIONS.

This contract will cover the furnishing and driving of piles indicated on plan of foundations. Test piles will be driven at several parts of foundation. Each pile will be carefully selected of a good quality of (name kind and maximum allowable variation from straight when tested with a straight edge), trimmed close, squared at both ends, of uniform size, not less than inches in diameter at small end, or inches at large end, and of length to make solid bottom according to test piles, driven not more than three feet from centres. Each pile must be driven vertically, in exact accordance with plan, until there is no movement of more than five inches under blows of 2,000 pound hammer falling twenty feet. Split and shattered piles, or those not driven vertical, must be removed, or another pile driven in its place. Brooming must be prevented by wrought iron ring. All piles shall be sawed off square at grade and capped with dimension stone, concrete, wood, steel grillage.

CONCRETE PILES.

Concrete piles shall be driven for the foundation as shown on drawing No.———. Piles shall be of the MacArthur, Raymond, Simplex or other type approved by the architect.

All piles must be constructed of Portland cement concrete of proportions hereinafter specified. Piles must be driven to elevations shown on the plans or as given by the architect, or else must be cut off to such elevations.

Piling is to be paid for by the lineal foot driven into position, the length to be measured from the point of the pile to the elevation of cut-off, as shown on plans or given by the architect.

Each system of piling must conform to the general specifications hereafter given for each particular kind. Additional detailed specifications for each kind shall be submitted for approval and shall become a part of the contract for the kind used.

It is planned to use piles feet long, but these lengths may not necessarily be used, but may be more or less than the above lengths, and the payment will be made only for the number of lineal feet actually driven in place. All piles shall be driven until ten blows of a No. 2 Vulcan Steam Hammer produce not more than one inch penetration; unless otherwise ordered by the architect.

Cement shall be Portland cement of such quality as will pass the requirements of the Canadian Society of Civil Engineers.

Sand used shall be suitable silicious material, passing the 20-mesh screen and retained on the 30-mesh screen, clean and free from impurities. Crystals to show no signs of decay.

Stone to be gravel or broken stone, clean and free from sand, earth or dust, of hard stone, to pass a two-inch ring and be refused by a three-quarter-inch ring.

The concrete for all types of piles to be 1-2-4 mixture.

PEDESTAL PILES.

Pedestal piles, as made by the MacArthur Concrete Pile & Foundation Company, shall be driven according to patent methods governing the same. The shaft or stem of the piles shall be 16 inches in diameter. They shall be formed by a pile apparatus consisting of a cylindrical steel casing and a core (or rammer) which fits inside the casing and extends below bottom of same.

This apparatus shall be driven into the ground to the required depth. The core shall then be removed and a charge of concrete dropped to the bottom of casing. This operation of charging and remaining shall be continued until a bulb or pedestal of the desired size has been formed. The casing shall be filled to the desired elevation with a wet mixture of concrete, and then pulled slowly and evenly out of the ground, leaving in place a 16-inch diameter shaft or stem, with an enlarged bulb or base.

RAYMOND PILES.

Raymond piles shall have a diameter at the top of not less than 20 inches, and at the bottom of not less than 8 inches. The sheet steel shell shall be reinforced by a spiral winding of ¼-inch wire, 3 inches on centres. Before filling with concrete, each shell shall be examined by lowering a light into it, and in case any shell is found to be distorted or defective in any way, it shall be removed and re-driven, or another shell driven inside the first. All such extra operations to be at the expense of the contractor.

SIMPLEX PILES.

Simplex piles shall be formed in the following manner: A heavy steel pipe, 16 inches in diameter, shall be fitted at its lower end with a detachable cast iron point or shoe and shall be driven into the ground to the desired depth. The pipe shall be filled to the desired height with a wet mixture of concrete and then pulled slowly and evenly out of the ground, leaving the cast iron point in place, surmounted by a 16-inch diameter concrete stem. All the concrete required to form the pile shall be placed in the pipe before beginning the removal of the pipe.

PRE-MOULDED OR CAST ABOVE GROUND PILES.

Pre-moulded piles shall be 16 inches in diameter and of circular cross section, or if a

square pile is used, it shall not be less than 14 inches square. They shall be reinforced with not less than six (6) $\frac{3}{4}$ -inch deformed bars, and also with a spirally wound drawn wire hooping not less than $\frac{1}{4}$ -inch in diameter, in spaces not more than six inches apart. All pre-moulded piles to be seasoned forty days before driving.

BRICK WORK AND MASONRY.

All brick work must be according to architect's drawings in dimensions, thickness, and height. The thickness of brick walls shall be according to city building by-laws. Ashlar facing shall be not less than _____ inches thick, properly clamped or bonded, and shall not be counted in the thickness of the wall. Hollow walls shall be not less than _____ inches thick on either side of the airspace. Face brick, dry pressed, enamelled, sand lime brick in this contract shall be carefully selected for evenness in face, color, and undamaged quality. The pressed brick in this contract shall be (make of brick), similar in all respects to samples given to architect with bid. Enamelled brick shall be (make of brick), similar in all respects to sample given architect with bid. All moulded forms necessary to complete architect's drawings must be the same manufacture as the face brick. Brick must be well set before laying, covered when left over night, cross joints well wiped back and front, frog up, walls carried up uniform, plumb and traced every four courses. Back wall laid common bond (three courses stretchers one headers), unless otherwise ordered by architect. Rake out joints for and point all flashings and frames, point as specified by architect. All details according to best brick-

laying practise, and in conformity with architect's drawings.

BRICK ARCHES.

Under this contract all arches shall be at least four inches thick. Arches over four feet in span shall increase in thickness toward the haunches by additional four inches in thickness, commencing two and one-half feet from centre of span, the second addition six and one-half feet, and increased, otherwise four inches for each additional four feet of span. Arches shall be laid on line to centres, with close joint; all bricks shall be wet and set in cement mortar of one part of cement to not more than two sand. All arches shall be grouted, pinned, and keyed.

COAL CHUTES.

In the foundation walls, _____ inches above grade to opening, is to be placed cast iron and steel coal chutes, as manufactured by _____ or equal. Same to consist of a cast iron frame of best quality grey cast iron, sufficiently rigid to withstand superimposed load of brick work and such rough usage as it may be subjected to, and to be built into wall in the manner of wooden window frames. The cast iron frame to be fitted with sheet steel hopper of best quality medium steel and cast iron door. The door to have automatic locking device which can only be opened from the inside, and which will retain the door in an upright position when open. The hopper is to be adjustable, swinging into position with the opening of the door, so as to form a receptacle for the coal, and swinging back through the wall with the closing of the door.

-
- Building Construction and Superintendence*, F. E. Kidder. The William T. Comstock Company, New York.
A treatise on Masonry Construction, I. O. Baker. Jno. Wiley & Sons, New York.
Patton's Practical Treatise on Foundations, Jno. Wiley & Sons, New York.
Building Construction, C. F. and G. A. Mitchell. W. Van Nostrand Company, New York.
Architectural Engineering, J. K. Freitag. Jno. Wiley & Sons, New York.
-

R. CHALKLEY & SON, LIMITED

Established 1875

34 VICTORIA ST.

TORONTO



Oddfellows Temple, College Street, Toronto, for which we were the
Masonry Contractors

Business General Contractors for Architectural Construction.

Specialist We specialize on masonry construction in which on account of our long experience we can guarantee perfect workmanship.

References Below are listed some of the buildings we have to our credit.

Building	Location	Architect
Lowes Warehouse	Sherbourne Street	Elmer Russel
Esther Howe School	Elizabeth Street	Board of Education
Regal School	Regal Avenue	Board of Education
The Toronto World	Richmond Street	C. J. Gibson
Balmoral Avenue Fire Hall		City Architect
Major Murray Residence	Whitney Avenue	Page & Warrington

Correspondence We solicit correspondence and will promptly attend to your needs.

THE GALT STOVE AND FURNACE CO. LTD.

GALT, - - - - - ONT.

Point out to your customers the following advantages of the Majestic Coal Chute and you'll effect many sales and reap a good profit.



Majestic Coal Chute (Closed)

It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way.

Unlike a glass window it cannot be broken.

Hopper can easily be removed if desired to put in very coarse coal or wood. Or if a wagon chute is used,

It swings back into the chute and allows the door to be closed and locked automatically. It can only be opened from the inside—hence it is burglar proof.

The door is made to lock when opened upward. It also affords protection to the building above the fuel opening where a great amount of damage occurs when throwing in fuel the ordinary way.

The use of the "Majestic" coal chute leaves the fuel opening always neat and clean.

The "Majestic" will give long service because it is made with a cast iron frame and a cast iron door and a steel body.

Send for a copy of our special coal chute booklet which describes the coal chutes minutely as well as some other lines, interesting to the building trade.



Model Coal Chute (Open)



Model Coal Chute with Rubber Gloss

MacARTHUR CONCRETE PILE AND FOUNDATION CO.

FOUNDATION CONTRACTORS

OTTAWA

197 Sparks Street

NEW YORK

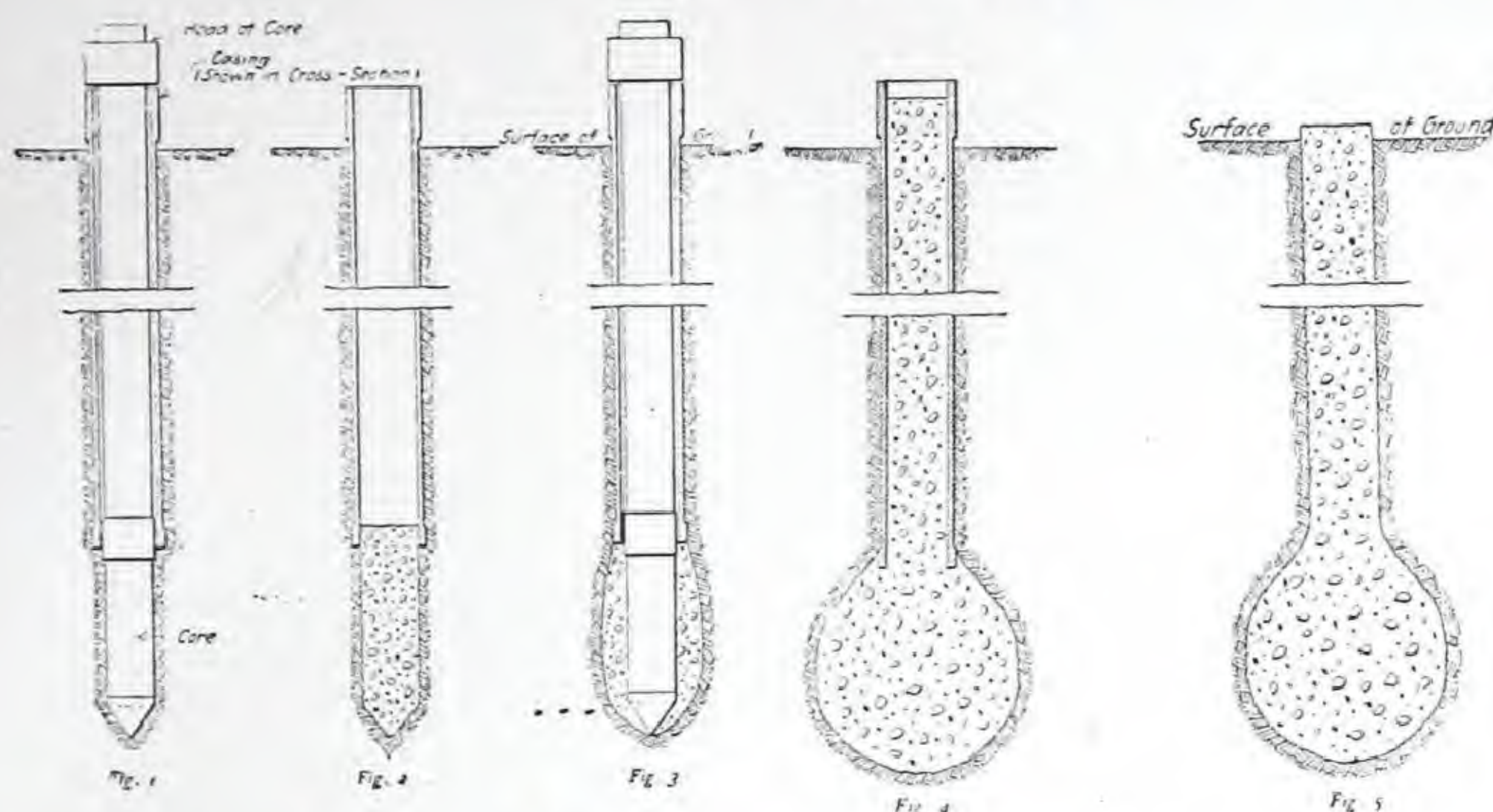
11 Pine Street

CHICAGO

Continental and Commercial
Bank Bldg.

SAN FRANCISCO

Chronicle Bldg.



Products

Pedestal Concrete Pile Foundations; also cast above ground piles, sheet piling and steel piling.

Pedestal Concrete Pile

The Pedestal Concrete Pile is a distinct and radical improvement in piling construction (see illustration). The spread base, about 3 feet in diameter, provides from 7 to 8 square feet of bearing area, transmitting a direct load to the compacted sub-soil in addition to the load carried by the frictional resistance of the pile column.

Method of Forming Piles

Fig. 1 shows cylindrical core and casing, which are first driven to the required depth.

Fig. 2 shows core removed and a charge of concrete dumped into the hole at the bottom of the casing.

In Fig. 3 the core is used as a rammer to bulge out and compress concrete into the surrounding soil. The process is repeated until the base is about 3 feet in diameter.

Fig. 4 shows the base completed and casing filled to the top with wet concrete.

The concrete Pedestal Pile is shown in Fig. 5, consisting of a monolithic concrete column about 16 inches in diameter, surmounting a broad base 3 feet in diameter.

References

Pedestal Piles have been driven for the Canadian Government, United States Government, leading railroads, manufacturing plants, gas companies, etc., etc. A million feet of piling have been driven in Canada and the United States.

Specifications

Insert the following clause in your Pile Specifications:—

"Size—The diameter of all piles shall be approximately 16 inches, and they shall have an enlarged foot or bulb at their lower ends, having a diameter of about three feet."

Co-operative Services

We are at all times willing to prepare plans and estimates on foundations, and to assist architects and engineers in obtaining foundations of greatest reliability at moderate cost.

Our literature, including our handbook—"The Pedestal Pile," will be gladly sent to those interested.

NOTES ON BRICKS

CLASSIFICATION OF BUILDING BRICK.*

Bricks are classified according to (1) the way in which they are moulded; (2) their position in the kiln while being burned; and (3) their form or use.

CLASSIFICATION ACCORDING TO METHOD OF MOULDING.

The method of moulding gives rise to the following terms:

Soft-mud Brick.—A brick moulded by placing soft clay in a mould. It may be moulded either by hand or with machinery.

Stiff-mud or Wire Cut Brick.—One moulded by forcing a prism of stiff clay through a die and afterwards cutting it up into bricks.

Pressed Brick.—One moulded by pressing dry or semi-dry clay into a mould.

Re-press Brick.—Usually a stiff-mud brick which has been subjected to an enormous pressure to render the form more regular and to increase its strength and density.

Sanded Brick.—Ordinarily, in making soft-mud brick, sand is sprinkled into the moulds to prevent the clay from sticking; the brick is then called sanded brick. The sand on the surface is of no serious advantage or disadvantage.

Machine-made Brick.—Brick is frequently described as "machine-made"; but this is very indefinite, since all grades and kinds are made by machinery.

CLASSIFICATION ACCORDING TO POSITION IN KILN.

When brick was generally burned in the old style up-draught kiln, the classification according to position was important; but with the new styles of kilns and improved methods of burning, the quality is so nearly uniform throughout the kiln that the classification is less important. Three grades of brick are taken from the old style kiln: arch brick, body brick, and salmon brick.

Arch or Clinker Bricks.—Those which form the tops and sides of the arches in which the fire is built. Being over-burned and partially vitrified, they are hard and brittle.

Body, Cherry, or Hard Bricks.—Those taken from the interior of the pile. The best bricks in the kiln.

Salmon, Pale, or Soft Bricks.—Those which form the exterior of the mass. Being under-burned, they are too soft for ordinary work, unless it be for filling. The terms salmon and pale refer to the color of the brick, and hence are not applicable to a brick made of a clay that does not burn red. Although nearly all brick clays burn red, yet the localities where the contrary is true are sufficiently numerous to make it desirable to use a different term in designating the quality. There is, necessarily, no relation between color, and strength

and density. Brick-makers naturally have a prejudice against the term soft brick, which doubtless explains the nearly universal prevalence of the less appropriate term—salmon.

CLASSIFICATION ACCORDING TO USE.

The form or use of bricks gives rise to the following terms:

Compass Brick.—One having one edge shorter than the other. Used in lining circular shafts, etc.

Feather-edge Brick.—One having one edge thinner than the other. Used in arches; and more properly, but less frequently, called *coussoir* brick.

Face Brick.—Those which, owing to uniformity of size and color, are suitable for the face of the wall of buildings. Sometimes face bricks are simply the best ordinary brick; but generally the term is applied only to re-pressed or pressed brick made specially for this purpose.

Sewer Brick.—Ordinary hard brick, smooth, and regular in form.

Paving Brick.—Very hard, ordinary brick. A vitrified clay block, very much larger than the ordinary brick, is sometimes used for paving, and is called a paving brick, but more often, and more properly, a brick paving block.

Vitrified Brick.—The introduction of brick for street pavements about 1890 led to a new grade of building brick, viz., vitrified brick, one burned to the point of vitrification and then annealed or toughened by slowly cooling. Vitrified brick and paving blocks, though originally made for paving purposes, are now much used in building and engineering structures.

SAND-LIME BRICKS.

Sand-lime bricks have been in use in Germany for the past fifty years, thus proving their weather-resisting qualities, and to a considerable extent are superseding the use of ordinary bricks on the Continent, where they are largely used both for public and private buildings. They are uniform in shape and have sharp edges, but are somewhat brittle and short in grain. The superior quality is imparted to them by an admixture of asbestos, which not only renders them stronger (their resistance to crushing strain being much greater), but also better non-conductors of heat, cold, or sound, and also more acid-proof and weather-resisting. Sand-lime bricks are "cured" in contact with live steam under pressure.

The quality of sand-lime bricks depends mainly upon the selection and treatment of the sand and the lime. Pure silica sands, containing a large percentage of fine grains, passing screens of from 80 to 150 mesh, are preferable. Clay should not be present in quantities of more than 5 per cent. The lime should be, preferably, high calcium lime, the

*A Treatise on Masonry Construction, Baker.

magnesium silicates formed by impure limes not being as strong as calcium silicates. Some manufacturers use hydrated lime, other hydrate the lime themselves, before mixing it with the sand, and others grind the quicklime, mix it with the sand and slake it in the sand.

The other most important element effecting quality is the press. After pressing and before steaming, the bricks are very fragile, and the press should be such that they are subjected to no slaking nor friction after the pressure is removed from the mould.

Tests.

If the sand is reasonably clean and pure, and the lime finely divided; and if the bricks are sound and have a good metallic ring, they will stand weather exposure perfectly.

If a brick stands in still water for an hour and the moisture rises more than $\frac{1}{2}$ an inch, it is not a first-class brick; if the moisture rises 2 inches, its use for facings is questionable; if the moisture rises 3 inches, it should not be used on outside work of any importance.

Authentic tests have been made for crushing, fire, frost and acid-resistance and for absorption, from which it may be concluded that under proper conditions of manufacture sand-lime bricks are produced having the following characteristics: Crushing strength, average, between 2,500 and 3,000 pounds per square inch, although some specimens in tests have shown over 5,000 pounds per square inch; modulus of rupture, average about 450 pounds per square inch; fire-resistance, but little inferior to that of fire-brick; frost-resistance, perfect; acid-resistance, very superior; absorption, from 8 per cent. to 10 per cent. in 48 hours; average for complete saturation, 15 per cent.; reduction of compressive strength by saturation for absorption test, average 33 per cent.

The bricks are square, straight and uniform in size and homogeneous in composition and density. They cleave accurately under the stroke of the trowel and present a weather surface with the good qualities of stone. They can be cut, carved or sand-blasted, are easily washed clean and show no efflorescence. These claims are well established for properly manufactured sand-lime bricks. It should be further stated that common bricks and facings are made in the same press, the only difference being in the selection of the materials and in the handling of the raw bricks. It is, therefore, claimed that a rational and homogeneous exterior wall structure is possible, since backings and facings may be built and bonded in even courses, with Flemish or other ornamental bonds.

VARIATION IN SIZE OF BRICKS.

Bricks vary in height from 2 inches to 3 inches, due to at least two causes: (1) a difference in the size of the forming mould; (2) the process by which they are solidified. It seems necessary to establish a minimum and a maximum dimension in height, allowing a variation of not more than one-eighth of an inch in the finished product. The difficulties

of estimating air-shrinkage and fire-shrinkage in clay brick is well known, but they are not such that they cannot be overcome. That some precaution is necessary can be very well illustrated by considering the difference in the amount of mortar in the face and back of a wall, where the bricks differ by one-eighth inch in height. The difference of one-eighth of an inch in the height of the bricks would mean a difference of one-half to the vertical foot of wall, assuming four bricks to the vertical foot. In a fifty-foot wall there is a difference of twenty-five inches in the amount of mortar. The mortar is the weaker material in the wall, and therefore the inside of the wall, which has to carry the floor loads and should be stronger, is weaker than the outside.

CLASSIFICATION ACCORDING TO STRENGTH.

There should also be a minimum requirement of strength in a definite period after a brick is made. Bricks, as they are used now, vary in crushing strength from 400 pounds per square inch to 7,000 pounds per square inch, and are classified according to appearance and not according to strength. The above mentioned brick showing a strength of 400 pounds per square inch would probably be used as a filler, and placed in the back of the wall where it would have to carry the greater portion of the load. It is because these poor bricks are used that building regulations are justified in allowing a compressive strength of from 50 to 75 pounds per square inch. This laxity in allowing the use of the poor bricks is the reason for discounting the strength shown in 85 per cent. of the bricks produced, for any of the modern kilns will show 85 per cent. of the bricks to be hard burnt.

EFFLORESCENCE OR SCUM ON BRICKWORK.*

Brick masonry, particularly in a moist climate or in damp places is frequently disfigured by the formation on the surface of a white deposit, which is called efflorescence. This deposit generally originates with the mortar, but frequently spreads over the entire face of the wall. The water which is absorbed by the mortar dissolves the salts of soda, potash, magnesia, etc., contained in the lime or cement, and on evaporating deposits these salts as a white efflorescence on the surface. With lime mortar the deposit is frequently very heavy, particularly on plastering; and, usually, it is heavier with natural than with Portland cement. The efflorescence sometimes originates in the brick, particularly if the brick was burned with sulphurous coal, or was made from clay containing iron pyrites; and when the brick gets wet, the water dissolves the sulphates of lime and magnesia, and on evaporating leaves the crystals of these salts on the surface. Frequently the efflorescence on the brick is due to the absorption by the brick of the impregnated water from the mortar.

*Masonry Construction, Baker.

This efflorescence is objectionable chiefly because of the unsightly appearance which it often produces, but also because the crystallization of these salts within the pores of the mortar and of the brick or stone causes disintegration which is in many respects like frost.

As a preventative, make the wall as impervious as possible by using some of the methods of damp-proofing. If the wall stands in damp ground, one or more of the horizontal joints should contain a layer of tarred paper bituminous felt, or other damp source to prevent the wall's absorbing moisture from below. Particular care should be taken during the erection of the building to see that the roof, cornice and gutters are made watertight; and all ducts that carry water or steam pipes should be waterproofed on their inner surfaces. After the building is finished, if the efflorescence appears, first of all any leakage of water into the wall must be stopped; and if the efflorescence is due to the penetration of rain-water through the exterior face of the wall, then the face may be rendered impervious by the application of one or more coats of waterproofing paint or wash, which will not materially darken or discolor the bricks.

Efflorescence will gradually be blown away by the winds and be washed off by the rains, but it can be entirely removed with scrubbing brushes and hydrochloric acid mixed with at least four or five times its volume of water. Before applying the acid, the wall should be well dampened; and after being scrubbed, the wall should be thoroughly washed with clear water.

NUMBER OF BRICK REQUIRED.

Since the size of brick varies greatly, it is impossible to state a rule which shall be

equally accurate in all localities. If the brick be of standard size ($8\frac{1}{4} \times 4 \times 2\frac{1}{4}$ inches) and laid with $\frac{1}{2}$ to $\frac{5}{8}$ -inch joints, a cubic yard of masonry will require about 410 brick; or a thousand brick will lay about $2\frac{1}{2}$ cubic yards. If the joints are $\frac{1}{4}$ to $\frac{3}{8}$ -inch, a cubic yard of masonry will require about 495 brick; or a thousand brick will lay about 2 cubic yards. With face brick ($8\frac{3}{4} \times 4\frac{1}{8} \times 2\frac{1}{4}$ inches) and $\frac{1}{8}$ -inch joints, a cubic yard of masonry will require about 496 brick; or a thousand face brick will lay about 2 cubic yards.

In making estimates for the number of bricks required, an allowance must be made for breakage, and for waste in cutting brick to fit angles, etc. With good brick, in massive work this allowance need not exceed 1 or 2 per cent; but in buildings 3 to 5 per cent. is none too much.

AMOUNT OF MORTAR REQUIRED.

The proportion of mortar to brick will vary with the size of the brick and with the thickness of the joints. With the standard size of brick ($8\frac{1}{4} \times 4 \times 2\frac{1}{4}$ inches), a cubic yard of masonry, laid with $\frac{1}{2}$ to $\frac{5}{8}$ -inch joints, will require from 0.35 to 0.40 cubic yards of mortar; or a thousand brick will require 0.80 to 0.90 cubic yard. If the joints are $\frac{1}{4}$ to $\frac{3}{8}$ -inch, a cubic yard of masonry will require from 0.25 to 0.30 cubic yard of mortar; or a thousand brick will require from 0.45 to 0.55 cubic yard. If the joints are $\frac{1}{8}$ of an inch, a cubic yard of masonry will require from 0.10 to 0.15 cubic yard of mortar; or a thousand brick will require from 0.15 to 0.20 cubic yard.

Ordinarily 0.4 barrel of unslaked lime or 1 barrel of lime paste and 0.4 cubic yard of sand will lay a thousand bricks.

Seger's Collected Works, The Kenfield Leach Company, Chicago.

Masonry Construction, I. O. Baker. Jno. Wiley & Sons, New York.

Building Stones and Clay Products, H. Ries. Jno. Wiley & Sons, New York.

Building Construction and Superintendence, F. E. Kidder. The William T. Comstock Company, New York.

MILTON PRESSED BRICK COMPANY, LIMITED

Toronto Office
50 Adelaide St. W.

Head Office
Milton, Ont.

Montreal Office
204 St. James Street

Product Milton Pressed Brick in a large assortment of colors and flashes.

Specialists We specialize and devote all our energies exclusively to the manufacture of the highest class **Face-Brick**.

**Experience in Manu-
facture** Our experience in Brick manufacture dates back 27 years. This long experience with splendid raw material and the best machinery and mechanics procurable have enabled us to place on the market a perfect brick.

Our Raw Material The **Milton** shale beds are recognized as being the best in Canada for brick manufacture being free from lime and gravel and having a very fine texture.

Variety of Colors We make the standard red and buff colors, also pink buff, red fire flash and **Fumed Flash**. The latter has a very rich effect shading from a-fumed oak to a dark brown.

Capacity Our output at the present time is 200,000 face brick per day enabling us to handle the largest contracts and give prompt delivery.

Facilities Size We ship via G. T. R. and C. P. R. to all parts of Canada. The size of our brick is $8\frac{3}{8} \times 2\frac{3}{8} \times 4$. In estimating figure 6 per sq. ft. surface.

Fiske "Tapestry" Brick We are Ontario Agents for the famous Fiske "Tapestry" Brick noted for its soft tones and rich effects.

Fireplaces We issue an art catalogue showing a large number of beautiful designs in different widths and heights ranging in price (complete) from \$20.00 to \$135.00.

**Informa-
tion** We will gladly forward above catalogue or any other information upon request.
Brick samples sent prepaid.

THE SUN BRICK COMPANY, LIMITED

Traders Bank Building

Toronto, Ont.

Manufacturers of

"SUN - TEX"

Clay Products

Product Texture Brick in a full range of colors and flashes, manufactured by the most modern methods and burned in a continuous gas fired kiln insuring a face satisfactory in every respect.

Denison Interlocking Tile used instead of common brick, makes a better, stronger and lighter wall.

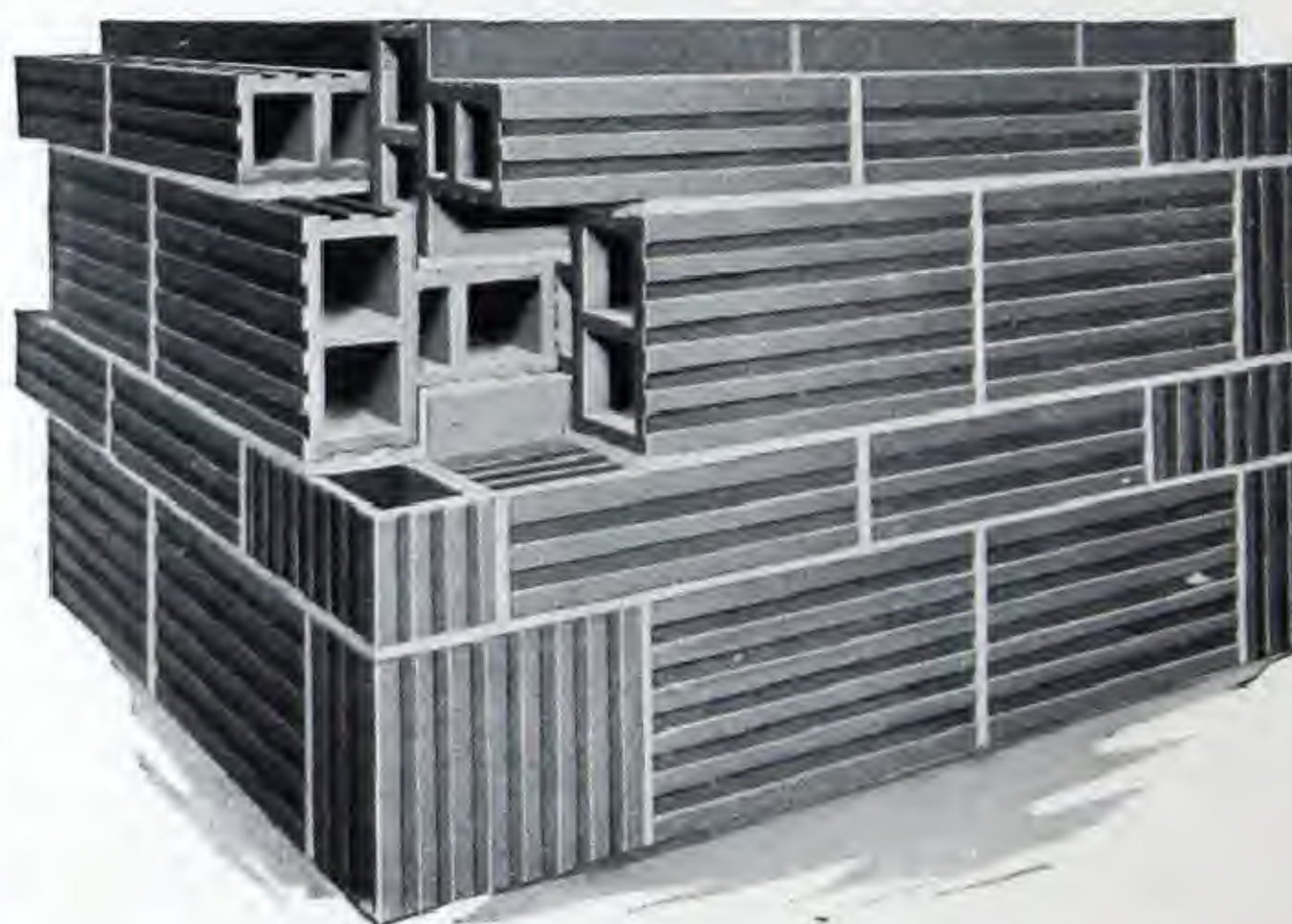
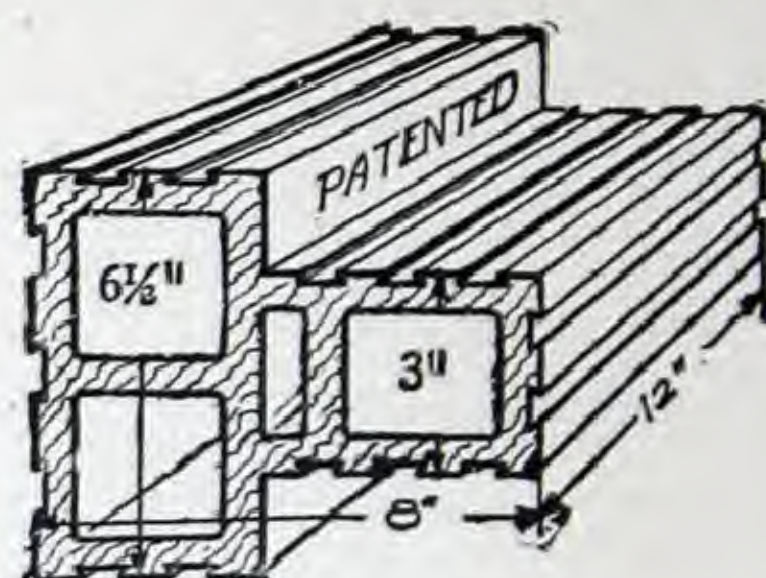
Description

Denison-Tile is sound, vermin, moisture, and fireproof.

Makes a non-conductive wall that is warm in winter and cool in summer.

Denison-Tile is inexpensive, lays up rapidly requiring little mortar and no furring, making a strong, light hollow wall. Every brick a header.

The bearing of floors can be put directly on **Denison-Tile** walls as the bearing webs are continuous from top to bottom of such a wall and in perfect alignment.



Tests We have conducted numerous tests proving **Denison-Tile** to be strong, non-conductive, fireproof, etc., copies of which we will gladly send on request.

Specifications, etc. We will gladly furnish specifications, booklets, etc., covering your requirements.

Ask for Booklet R.

REINFORCED CONCRETE CONSTRUCTION

General.

The term "reinforced concrete" as used in this specification, is to be understood to mean an approved concrete mixture reinforced by steel of any shape so combined that the steel will take up the tensional stresses and assist in the resistance to shear; and the construction must be of such a nature that the stresses can be calculated by the accepted formulae of modern engineering practice.

The contractor is to build the reinforced concrete work complete, as shown and required by the drawings, and in accordance with the regulations of the (local by-laws).

The contractor is to furnish all labor and materials for the construction of the reinforced concrete work. He is to build all concrete work of whatsoever nature, excepting

.....
All footings for walls, columns and partitions are to be included. The contractor is also to construct all area and other walls and all stairs of reinforced concrete where required by the drawings.

All reinforced concrete construction shall be performed under the personal and constant supervision

Inspection by the engineer or superintendent in charge shall cover the following:

- (a) The materials;
- (b) The correct construction and erection of the forms and supports;
- (c) The sizes, shapes, arrangements and fastening in position of all reinforcements;
- (d) The proportioning, mixing and placing of the concrete;
- (e) The strength of the concrete by tests of standard test pieces made during the progress of the work;
- (f) Whether the concrete is sufficiently hardened before the forms and supports are removed;
- (g) Prevention of injury to any part of the structure by and after removal of the forms;
- (h) Comparison of dimensions of all parts of the finished structure with the plans.

The execution of reinforced concrete work shall be confined to workmen accustomed to this class of construction, who shall be under the control of a competent foreman.

The contractor is to perform all labor and furnish all material for the construction of all forms and woodwork necessary to complete the concrete work. The beam, girder and column forms are to have sides at least 1½ inches thick, and the centering for the slabs is to consist of 1 inch material, tongued and grooved and battened together into panels.

FORMS, CENTERING, SHORES, ETC.

All forms shall be built rigid, plumb, and true, thoroughly braced and with tight joints so that no appreciable part of the concrete

mixture can escape, and their interior dimensions must conform to the dimensions of the concrete sections shown upon the approved plans. All forms shall be supported so as to carry the dead load of the construction as a liquid without spring or deflection, and any form that becomes twisted or warped shall be correctly adjusted before concrete is placed therein. Building paper will not be allowed in forms for any purpose whatsoever.

If forms are to be hung from steel beams the hangers and the method of hanging shall be subject to the approval of the Architect, and no hangers that are difficult to remove shall be used.

The forms for beams, girders and lintels shall be so designed that at least one side of each beam or girder may be removed without disturbing the bottom portion of the form or its supports.

All posts supporting forms for slabs, beams or girders must rest upon wedges which can be loosened and removed without producing undue strains in the floor or roof system.

Posts which are to be supported from the ground must be provided with footings of sufficient area to do away with any liability of appreciable settlement owing to insufficient foundation.

All column forms shall have an opening left at the bottom to enable cleaning out and adjustment of the steel to be attended to, which opening is not to be closed until the column is to be poured.

All shavings, chips, sawdust, ice or other foreign matter must be removed from within all forms before concrete is placed therein.

CEMENT.

Only Portland cement will be accepted in reinforced concrete construction, and this cement must comply in all respects with the specifications of the Canadian Society of Civil Engineers.

AGGREGATES.

Extreme care shall be exercised in selecting the aggregate for mortar and concrete, and careful tests must be made where any doubt exists of the materials for the purpose of determining their qualities and the grading necessary to secure maximum density or a minimum percentage of voids.

Fine aggregates shall be uniformly graded from coarse to fine and consist of sand, crushed stone or gravel screenings, passing when dry, a screen having one-quarter inch diameter holes, and not more than six per cent. passing a sieve having 100 meshes per lineal inch. It shall be of clean silicious material free from vegetable loam and other deleterious matter.

Mortars composed of one part Portland cement and three parts fine aggregate, by weight, when made into briquettes, shall show a tensile strength of at least 70 per cent. of the strength of 1:3 mortar of the same

consistency made with the same cement and standard Ottawa sand.

Coarse aggregate shall consist of inert material such as crushed stone or screened gravel which is retained on a screen having one-quarter inch diameter holes. The particles shall be clean, hard, durable and free from dust or other deleterious material, and the maximum size shall pass in any direction through a one-inch diameter ring. A graduation of the size of the particles from fine to coarse will be considered advantageous.

Samples of all aggregates must be submitted to the Architect and his approval of them obtained before being used in any work.

REINFORCEMENT.

All steel used for reinforcement shall be medium steel made by the Open Hearth or Bessemer processes, and be rolled from new billets. No re-rolled steel will be allowed. The steel shall have an ultimate tensile strength of not less than 60,000 pounds per square inch of net cross section, and an elastic limit of at least one-half of this ultimate strength, and for sizes up to $\frac{3}{4}$ inch in diameter shall bend cold 180 degrees around a diameter equal to the thickness of the piece tested without sign of fracture on the outside of bent portion. For sizes greater than $\frac{3}{4}$ of an inch in diameter it shall bend cold 180 degrees around twice its own diameter without sign of fracture on the outside, except in cases where all bends necessary in the construction are to be made hot, in which case the steel shall bend cold 90 degrees around its own diameter without sign of fracture.

All reinforcing steel shall be free from checks, cracks, flaws or other imperfections, also free from paint, oil, dirt, grease or heavy rust or scale.

If deformed bars are used, only the net section—the section exclusive of all projections—of the area of such bars shall be considered effective.

Tests of the steel proposed to be, or being, used in any reinforced concrete structure shall be made at the expense of , and such tests shall be made at a place satisfactory to, and under the supervision and direction of, the architect.

MIXING.

Methods of measurement of the proportions of the various ingredients, including water, in each batch shall be used which will secure separate uniform measurements at all times. The use of boxes specially constructed for the purpose will be preferred, but the use of iron wheelbarrows may, with the consent of the architect, be used for measuring stone and sand. Water is to be added by measure and not by hose.

All concrete materials shall be measured loose.

All concrete must be machine mixed, using a batch mixer of an approved design if the amount of concrete in the work exceeds fifty (50) cubic yards.

A competent foreman must be in constant attendance at the mixer to give his approval of every batch which leaves the machine.

When the amount of concrete does not exceed fifty (50) cubic yards, the mixing may be done by hand on a smooth, watertight platform, not less than fourteen feet by twelve feet square, and having a raised rim around the edge at least three inches in height. The fine aggregate shall be first evenly spread on this platform and the proper proportion of cement shall then be spread over the aggregate, when the ingredients shall be thoroughly mixed with hoes or shovels, then spread out evenly over the platform while in a dry state. Clean water shall then be applied and the cement and fine aggregate thoroughly mixed until a mortar of the proper consistency is formed, which shall be evenly spread over the platform. The stone or gravel after being wetted shall then be evenly spread over the mortar and the whole mass thoroughly mixed with shovels and hoes by being turned over and worked at least three times, not counting the shovelling off the platform. No more than three-quarters of a cubic yard shall be mixed in any one batch.

The materials must be mixed wet enough to produce a concrete of such consistency as will flow into the forms and about the metal reinforcement, and which at the same time can be conveyed from the mixer or platform to the forms without separation of the coarse aggregate from the mortar.

Retempering mortar or concrete, i.e., remixing with water after it has partially set, will not be permitted.

PLACING CONCRETE.

Concrete shall be deposited in the forms as rapidly as possible after leaving the mixer, and under no circumstances shall concrete be used that has attained initial set before final placing, nor shall such concrete be returned to the mixer.

When placing concrete is once started, it shall, if possible, be carried on as a continuous operation until the pouring of the section or panel is completed.

When being deposited or poured, the concrete shall be agitated continuously with suitable tools, such as a straight shovel or slicing tool kept moving up and down until all the ingredients have settled to their proper place by gravity, and the surplus water has been forced to the surface. Filling the forms completely and puddling afterwards will not be permitted. In placing the concrete the work shall be so laid out that the partly set concrete shall not be subjected to shocks from men hauling or wheeling material over it.

Before placing concrete, care shall be taken to see that the forms are constructed as hereinbefore specified and thoroughly wetted, and the space to be occupied by the concrete free from debris.

When the placing of concrete is suspended all necessary grooves for joining future work shall be made before the concrete has had time to set. When work is resumed concrete

previously placed shall be roughened, thoroughly cleansed of foreign material and laitance, drenched and slushed with a mortar consisting of one part Portland cement and not more than two parts of fine aggregate.

Care must be taken to stop work at such a point that the joint formed when the work is resumed will have the least possible effect on the strength of the structure. Footings shall be cast to their full depth at one operation.

Construction joints in beams and girders shall be vertical and at a point midway between supports, unless a beam is located at this point, in which case the joint shall be offset at a distance equal to twice the width of the beam.

Construction joints in slabs shall be near the centre of the span. No joint will be allowed between slab and beam or girder.

Any concrete which may run past the bulkheads must be cleaned up and removed before the concreting of the next section is started.

Where brackets are used, the brackets will be considered a part of the beam or girder.

All columns are to be poured a sufficient length of time ahead of the floor construction to allow the concrete in the column to properly set up. The pouring of a column must be in one continuous operation to the bottom of the beam or girder it supports, and during the pouring the concrete shall be well stirred or puddled with a long rod or tamp to expel all bubbles of air and prevent voids and honeycombing. Joints in columns shall be perpendicular to the axis of the column.

In slab construction the finish must be laid integrally with the rest of the slab or it will not be considered as part of the slab in calculating the strength of the same.

Whenever possible, the edges of girders, beams and columns shall be chamfered and the sides of beams and girders splayed in order that the forms may be more easily removed.

All reinforcing steel shall be accurately located in the forms and secured against displacement, and the lateral spacing of the steel in lintels, beams or girders shall not be less than two and one-half diameters centre to centre.

No concrete shall be poured until the engineer or superintendent in charge has examined the particular section in which it is desired to proceed with this portion of the work, and has expressed himself satisfied with the structural condition and cleanliness of the forms, and the placing, splicing and fastening in its proper position of the steel reinforcement.

When concreting is carried on in freezing weather, the material must be heated and such provisions made that the concrete can be put in place without freezing. The use of frozen, lumpy sand or stone depending on hot water used in mixing to thaw it out will not be permitted.

All concrete shall be kept at a temperature above freezing until it has thoroughly hardened, and all concrete which is frozen shall be removed.

Concrete placed in warm weather, or which from any other cause is exposed to premature drying, shall be kept thoroughly wet during the first week after being put in place.

Concrete shall not be placed in water unless unavoidable, but when this cannot be avoided, unusual care must be exercised to prevent the cement from being floated away, also to prevent the formation of laitance. The concrete shall be deposited through a metallic tube or from a bucket having a bottom dump, and care shall be taken to keep the surface of the concrete as nearly horizontal as possible. The proportion of cement in concrete deposited under water shall be 25 per cent. in excess of that required for similar work deposited in the ordinary way.

REMOVAL OF FORMS.

Forms shall not be removed until the concrete is thoroughly set and is of sufficient strength to carry its own weight together with whatever live load is liable to come on the construction.

No form shall be removed without the approval of the architect or engineer or the superintendent in charge of the structure.

The original supports for beams and girders must remain in place for at least twenty-one days after the concrete has been poured and before these supports are interfered with, the entire forms must be removed from supporting columns and the sides of beams and girders stripped so as to enable a thorough examination of the concrete to be made.

The form shall not be removed from columns in less than six days, and forms supporting floor slabs shall not be removed in less than ten days after the concrete has been poured. The sides of forms for beams and girders may be removed at the same time as the forms supporting the floor slabs.

TIES FOR FACE BRICKWORK.

The contractor is to provide and place in the forms copper ties to secure the face brickwork to the concrete construction. These copper ties are to be $\frac{3}{4}$ by $\frac{1}{16}$ inch in cross-section by 8 inches in length. The ends of the copper ties are to be bent over to secure a hold in the mortar joints of the brickwork. The ties are to project at least 4 inches into the concrete work, and are to be placed so that there will be one tie to each two square feet of face brickwork.

GENERAL ASSUMPTIONS.

As a basis for calculations for the strength of reinforced concrete construction, the following assumptions shall be made:

- (a) A plane section before bending remains plane after bending.
- (b) The modulus of elasticity of concrete in compression within the usual limit of working stresses is constant.
- (c) In making calculations the tensile stress of concrete shall not be considered.

- (d) The steel shall take all the tensile stresses.
- (e) Perfect adhesion is assumed between concrete and reinforcement. Under compressive stresses the two materials are, therefore, stressed in proportion to their moduli of elasticity and their distance from the neutral axis.
- (f) The ratio of the modulus of elasticity of steel to the modulus of elasticity of concrete shall be assumed to be fifteen for concrete with a crushing strength of 2,000 pounds per square inch after hardening for 28 days.
- (g) Initial stress in the reinforcement due to contraction or expansion in the concrete may be neglected.

The span length of beams and slabs shall be taken as the distance from centre to centre of supports, but shall not be taken to exceed the clear span plus the depth of the beam or slab. Brackets shall not be considered as reducing the span.

The dead load shall include the weight of the structure and all fixed loads and force.

The live load shall include all loads and forces, which are variable.

The weight of reinforced concrete shall be taken as 150 pounds per cubic foot.

BENDING MOMENTS.

The bending moments for slabs and beams, when not continuous over supports, shall be taken at not less than

$$\frac{WL}{8}$$

When slabs and beams are built continuous over two or more supports, the bending moment shall be taken at not less than

$$\frac{WL}{10}$$

When slabs and beams are continuous over one support only, the bending moment shall be taken at not less than

$$\frac{WL}{9}$$

In the case of square panels reinforced in both directions and continuous over all supports, the bending moment of the slab shall be taken at not less than

$$\frac{WL}{20}$$

provided, however, that when square floor slabs reinforced in both directions are contiguous to walls, the bending moment of the slab shall be taken at not less than

$$\frac{WL}{18}$$

W = Total uniformly distributed load.

L = Span of beam or slab.

The length of a slab in which reinforcement in both directions will be allowed for is limited to one and a half times the width.

If L be the longer space of the panel, and B the shorter, then the bending moments given above may be reduced by the factor

$$\frac{B^4}{L^4+B^4} \text{ for the longer span, and by } \frac{L^4}{L^4+B^4}$$

for the shorter span, in order to obtain the actual bending moment. The reinforcement spanning the shortest direction shall be placed below the reinforcement spanning the longer direction.

In all cases where reduction in the bending moment is allowed on account of continuous action, sufficient steel reinforcement must be provided in the top of the slab or beam over the support to meet the requirements of the accepted theory of flexure, and this upper reinforcement shall extend on both sides a sufficient distance beyond the centre of the support to develop adhesion equal to at least the strength of the upper bars on the basis of the allowable unit stresses.

If the girders, beams and slabs are poured in one continuous operation, then the girders or beams may be treated as T-beams with a portion of the slab acting as a flange. In no case shall the overhanging width on each side of the girder or beam exceed four times the thickness of the slab, and the total width of the flange shall not exceed five times the width of the girder or beam.

In beam and slab construction, an effective metallic bond shall be provided at the junction of the beam and slab, and where reinforced concrete girders carry reinforced beams, the portion of the floor slab acting as flange to the girder must be sufficiently reinforced with bars near the top, at right angles to the girder, to enable local loads to be transmitted directly instead of through the beams to the girder, thus avoiding an integration of compressive stresses due to simultaneous action as floor slab and girder flange.

In the design of T-beams acting as continuous beams, due consideration shall be given to the compressive stresses at the support at the bottom of the beam.

When the overall vertical distance of the tension members of a girder or beam is greater than one-sixth of the total depth of the girder or beam, the stresses in members shall be computed in proportion to the distance from the neutral axis.

Shrinkage and thermal stresses must be provided for by the introduction of steel.

PROPORTION OF CONCRETE AND ALLOWABLE STRESSES ON CONCRETE AND STEEL.

All concrete for columns, girders, beams, slabs, walls, fireproofing or piles shall be composed of materials meeting the requirements of these regulations, and be mixed as hereinbefore specified, in the proportion of not less than one part of cement to two parts of fine aggregate and four parts of coarse aggregate, or in such other proportions as may be necessary to make the resistance of the mixture to

crushing not less than two thousand (2,000) pounds per square inch after hardening for 28 days.

Tests to determine this value must be made at the expense of the _____ when required by the architect, at a place and by a person satisfactory to him, and under the direct supervision of either the said architect or a person representing him.

When the proportion of cement is increased and the quality of aggregates hereinbefore called for used, an increase may be made on the allowable working stresses proportional to the increase in compressive strength at 28 days, as determined by actual tests, but this increase shall not exceed 25 per cent. On this basis the following maximum stressed for 1-2-4 concrete will be allowed in construction.

- (a) Compression in extreme fibre of girders, beams and slabs, 600 pounds per square inch.
- (b) Direct compression, 450 pounds per square inch.
- (c) Shearing stress, when diagonal tension is not resisted by steel, not to exceed 100 pounds per square inch of effective cross section.
- (d) Shearing stress, when all diagonal tension is resisted by steel, not to exceed 100 pounds per square inch of effective cross section.

Members of web reinforcements shall be designed so as to adequately take up all involved stresses throughout their entire length. They shall not be spaced to exceed three-fourths of the depth of the beam in that portion where the web stresses exceed the allowable shearing value of the concrete.

Web reinforcement, unless rigidly attached, shall be placed at right angles to the axis of the beam and looped around the extreme tension member.

- (e) For T-beams the width of the stem only shall be used in calculating the shear.
- (f) The resisting moment in inch-pounds of a rectangular beam, shall be taken as $95 B D^2$ (moment arm— $.88 D$).
 B = Breadth of beam in inches.
 D = Effective depth of beam in inches.
- (g) Adhesion to plain steel bars, 60 pounds per square inch of surface of bar.
- (h) Adhesion to deformed steel bars, up to 100 pounds per square inch of surface of bar may be permitted.
- (i) For compression in columns with not less than 1 per cent., and not more than four per cent., of longitudinal reinforcement, the safe load shall be computed as follows:
 Safe load (in pounds) — $.450 (A_c + 15 A_s)$.

A_c = Net cross sectional effective bearing area of concrete in square inches.

A_s = Cross sectional area of longitudinal reinforcement in square inches.

- (j) For columns reinforced with both longitudinal steel and spirally wound

hooping, when the volume of hooping is equal to at least one per cent. of the volume of the enclosed concrete, and the longitudinal reinforcement is not less than one per cent. and not more than four per cent. of the cross sectional area, the safe load shall be computed as follows:

Safe load (in pounds) — $650 (A_c + 15 A_s)$.

A_c = Net cross sectional area of concrete enclosed in hooping in square inches.

A_s = Cross sectional area of longitudinal reinforcement in square inches.

The foregoing allowed stresses shall be used only where the unsupported length of the columns is not greater than 15 times the least diameter of effective bearing area. Where the length exceeds this limit, the allowable stress shall be reduced according to approved standard formula.

Bending stresses due to eccentric loads on columns shall be provided for by increasing the section of concrete or steel until the maximum stress on a column will not exceed the allowable working stress.

The least diameter of effective bearing area is to be understood to mean the distance from inside to inside of hooping in columns with spiral hooping, and in others from outside to outside of longitudinal reinforcement.

The pitch of spiral reinforcement shall not be greater than one-sixth of the effective diameter of a column, and in no case more than three inches, and adequate means must be provided to hold it in place so as to form a column, the core of which will be straight and well centred.

When columns are reinforced with longitudinal rods only, the reinforcement shall be tied together with bands, not less than one-quarter of an inch in diameter, placed not more than the effective diameter of the column apart, or in any case not more than twelve inches. The bands to be jointed in such a manner as to do away with any liability of the reinforcement spreading, and shall be wired to each longitudinal rod.

No column shall have less than sixty-four square inches of effective area or a dimension of less than eight inches.

When longitudinal reinforcing rods in columns have an area in excess of one and one-fourth square inches, the ends shall be faced or milled off normal to the longitudinal axis, and such rods shall have full and perfect bearings, and a tight-fitting sleeve or other approved appliance shall be provided at each joint to keep the rods in their proper position.

When longitudinal reinforcing rods in columns have an area of less than one and one-fourth square inches, the rods may be lapped and securely wired together, the splice to be of a sufficient length to develop by adhesion the strength of the rod.

All butted joints shall be made at the floor levels or at points where the columns may

be considered as fixed, and the centre of lapped joints shall not be more than one foot above floor levels or points at which rigid lateral support is afforded the columns. The ends of all rods at the base of columns shall be made smooth and right angled from the longitudinal axis, and such rods shall have a perfect bearing on a steel plate or casting of sufficient size and strength to distribute the load which the column supports to such an extent that the allowable compressive stress per square inch on the material under this plate shall not be exceeded, or in lieu of the plate the stress may be distributed in concrete footings to the required extent by means of dowels of sufficient length and area to sustain the weight by adhesion of the concrete to the steel, without exceeding the specified limit for such in this regulation. The tops of all dowels to extend to the top of the footing and be made perfectly level and smooth to receive the longitudinal reinforcing rods, and the joint between the dowels and the rods to be made with a pipe sleeve which is to be grouted into the footing at least six inches and extend six inches above the top of same, and the reinforcing rods, after being secured in their proper position, are to be solidly grouted into the sleeves with liquid Portland cement.

The area required in footings which have to support columns having both spiral hooping and vertical reinforcement shall be obtained in a similar manner to that immediately above specified for columns with vertical reinforcement only. The longitudinal reinforcing bars in all columns shall be straight and sufficient metallic lateral support shall be provided to keep them in their proper place until the concrete in the column has set.

The allowable stress on steel in tension shall be sixteen thousand (16,000) pounds per square inch.

Where it is necessary to introduce steel to resist compression in girders, beams, or slabs,

the compressive stress per square inch allowed on such steel shall not exceed fifteen (15) times the computed compressive stress in the concrete at the same distance from the neutral axis. All such steel shall be anchored into the mass of concrete in such a way as to prevent any possibility of buckling.

The minimum protection for steel reinforcement, which is to be taken, is the distance from the surface of the steel to the nearest concrete surface, shall be:

- (a) For girders and columns, two inches.
- (b) For beams and lintels, one inch and a half.
- (c) For floor and roof slabs, one inch.

TILE AND REINFORCED CONCRETE JOIST CONSTRUCTION.

When tile and reinforced concrete joist construction is used for floors, the tile should be sound, hard burned, free from shrinkage cracks, of uniform size and corrugated in a horizontal direction upon the sides.

When concrete tile and reinforced concrete joist construction is used for floors, the tile should be sound, hard, well seasoned, corrugated in a horizontal direction upon the sides.

The reinforced concrete joists should be parallel and in perfect line, and of sufficient width to develop the steel, which steel is to be protected from fire with concrete of a similar mixture and thickness to that hereinbefore specified for concrete beams. Should concrete be required on the top of the tile to take compressive stress, it should be not less than two inches in thickness and should be poured at the same time as the joists, and be of the same mixture. The tile should be thoroughly soaked with water before the pouring of the concrete is commenced. In this class of construction the dead and entire live loads should be assumed to be carried by the reinforced concrete joists.

Concrete, Plain and Reinforced, Taylor and Thompson. Jno. Wiley & Sons, New York.

Concrete Specifications, J. Cochran. The W. Van Nostrand Company, New York.

Cements, Limes and Plasters, E. C. Eckel. Jno. Wiley & Sons, New York.

Concrete Construction, Methods and Costs, H. P. Gillette. M. C. Clark Publishing Company, Chicago.

Reinforced Concrete, by Chas. F. Marsh. D. Van Nostrand Co., New York.

Experimental Researches on Reinforced Concrete, Armand Considere. McGraw Publishing Co., New York.

TRUSSED CONCRETE STEEL CO. OF CANADA, LIMITED

Head Office and Works:
WALKERVILLE, ONTARIO

BRANCHES

T. H. Stevens
23 Jordan St., Toronto
O. E. Harmon and A. St. Clair Riley
Union Bank Bldg., Winnipeg

G. B. Reynolds,
128 Coristine Bldg., Montreal
R. E. W. Hagarty
52 Hutchison Bldg., Vancouver, B.C.

KAHN TRUSSED BAR



Kahn Trussed Bar

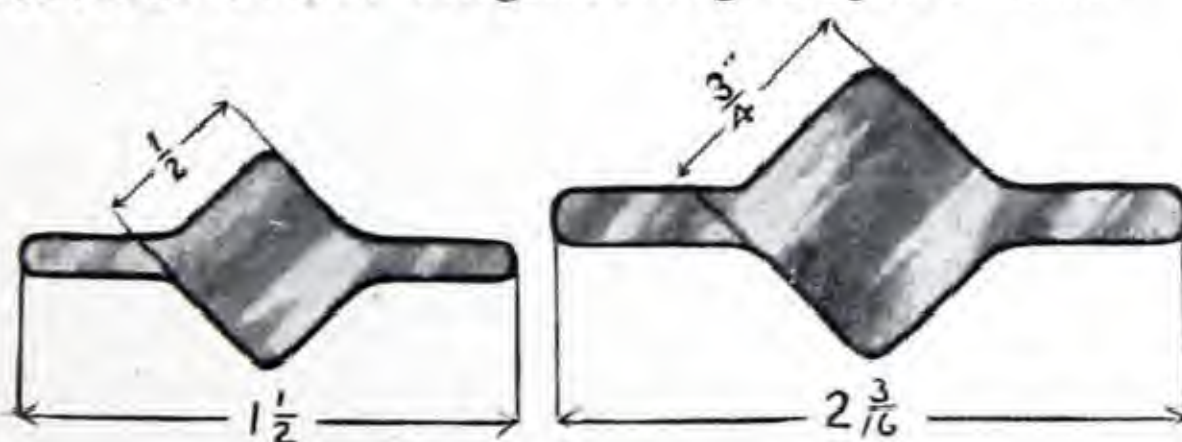
The Kahn Trussed Bar for reinforcing concrete consists of a main horizontal bar and rigidly connected diagonal shear members. The cross section of the bar has two horizontal flanges at opposite sides. These flanges are sheared up at intervals to form the rigidly connected diagonals making a unit of main bar and shear members.

The Kahn Trussed Bar, the main product of the well-known Kahn System of Reinforced Concrete, has a record of successful use in over 10,000 structures in this country and abroad, and has received the endorsement of the United States Government, architects, engineers and builders.

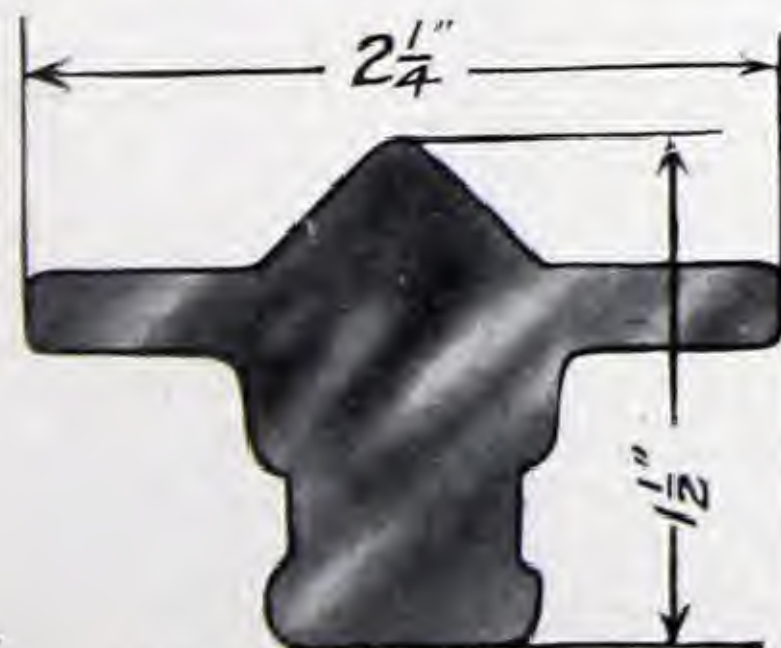
The Engineering Department of the Trussed Concrete Steel Company prepares, without charge, detail drawings of re-inforced concrete work in any structure in which Kahn Trussed Bars are used. The drawings show clearly the exact location of each reinforcing bar and the detailed size of all the concrete work.

Each bar is designed for its distinct place in the structure, and is plainly marked so that the builder can tell from the drawings just where it belongs. We especially ask architects, engineers, and builders to avail themselves of the services of our Engineering Department.

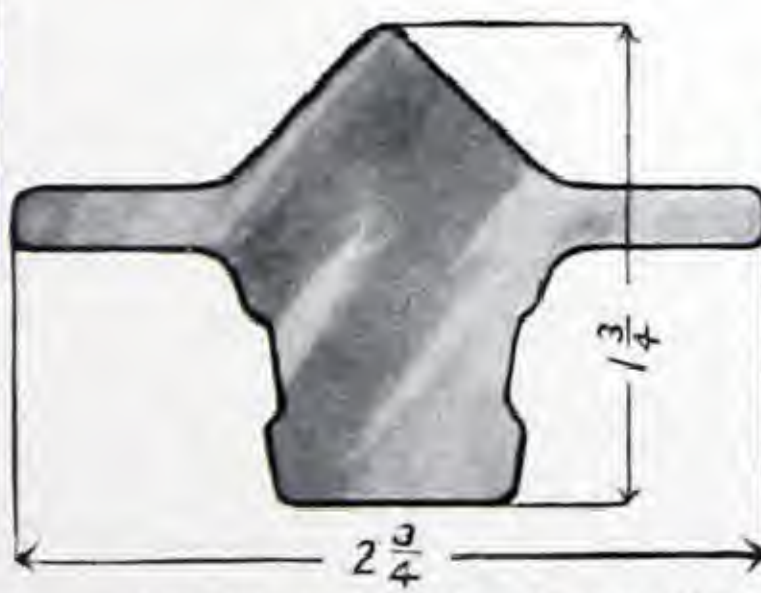
$\frac{1}{2}$ in. x $1\frac{1}{2}$ in. Kahn Trussed Bar. Weight, 1.4 pounds per foot; Area, 0.41 square inches; Standard length of diagonals, 6 inches.



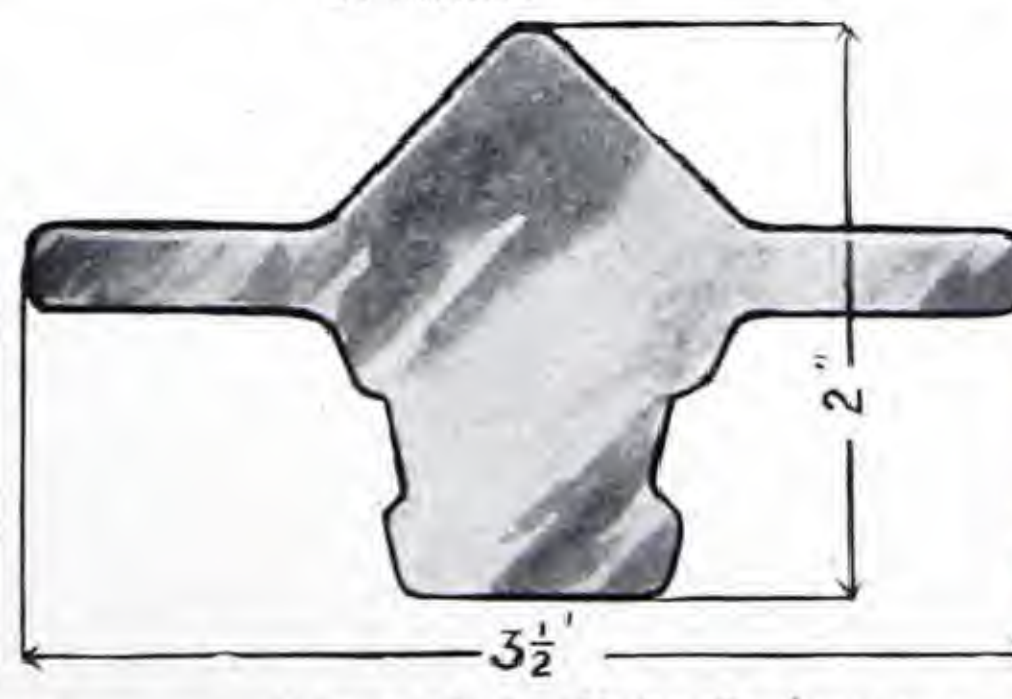
$\frac{3}{4}$ in. x 2 3-16 in. Kahn Trussed Bar. Weight, 2.7 pounds per foot; Area, 0.79 square inches; Standard length of diagonals, 12 inches; Special lengths, 8 inches, 18 inches, and 24 inches.



$1\frac{1}{2}$ in. x $2\frac{1}{4}$ in. Kahn Trussed Bar. Weight, 4.8 pounds per foot; Area, 1.41 square inches; Standard length of diagonals, 24 inches; Special lengths, 18 inches and 30 in.



$1\frac{3}{4}$ in. x $2\frac{3}{4}$ in. Kahn Trussed Bar. Weight, 6.8 pounds per foot; Area, 2.00 square inches; Standard length of diagonals, 24 inches; Special lengths, 18 inches and 30 in.



2 in. x $3\frac{1}{2}$ in. Kahn Trussed Bar. Weight, 10.2 pounds per foot; Area, 3.00 square inches; Standard length of diagonals, 30 inches; Special length, 24 inches.

Continued on next page

TRUSSED CONCRETE STEEL CO. OF CANADA, LIMITED



Rib Bars

The Rib Bar for reinforcing concrete is a special rolled section with a series of cross ribs so designed as to secure maximum grip on the concrete.

The Rib Bar is manufactured from the highest grade of open hearth steel with an elastic limit of 50,000 lbs. per square inch. The quality of steel is such as to give a bar of greater strength without sacrificing ductility.

Supplied in all sizes varying by eighths of an inch from $\frac{3}{8}$ inch diameter up to $1\frac{1}{4}$ inch, and in any length up to sixty feet.

Any special grade of steel can be provided in Rib Bars if the order is of sufficient size.

Rib Metal

A reinforcing material for Concrete Slabs, Walls and Conduits—Consist of a series of nine straight bars or ribs, rigidly connected by cross members formed from the same sheet of steel. These cross members accurately space and thoroughly anchor the main bars in the concrete, providing a perfect cross reinforcement against temperature and shrinkage strains.

Rib Metal saves labour and assures accuracy in placing.

Rib Metal is stiff and rigid—not pliable and wiry.

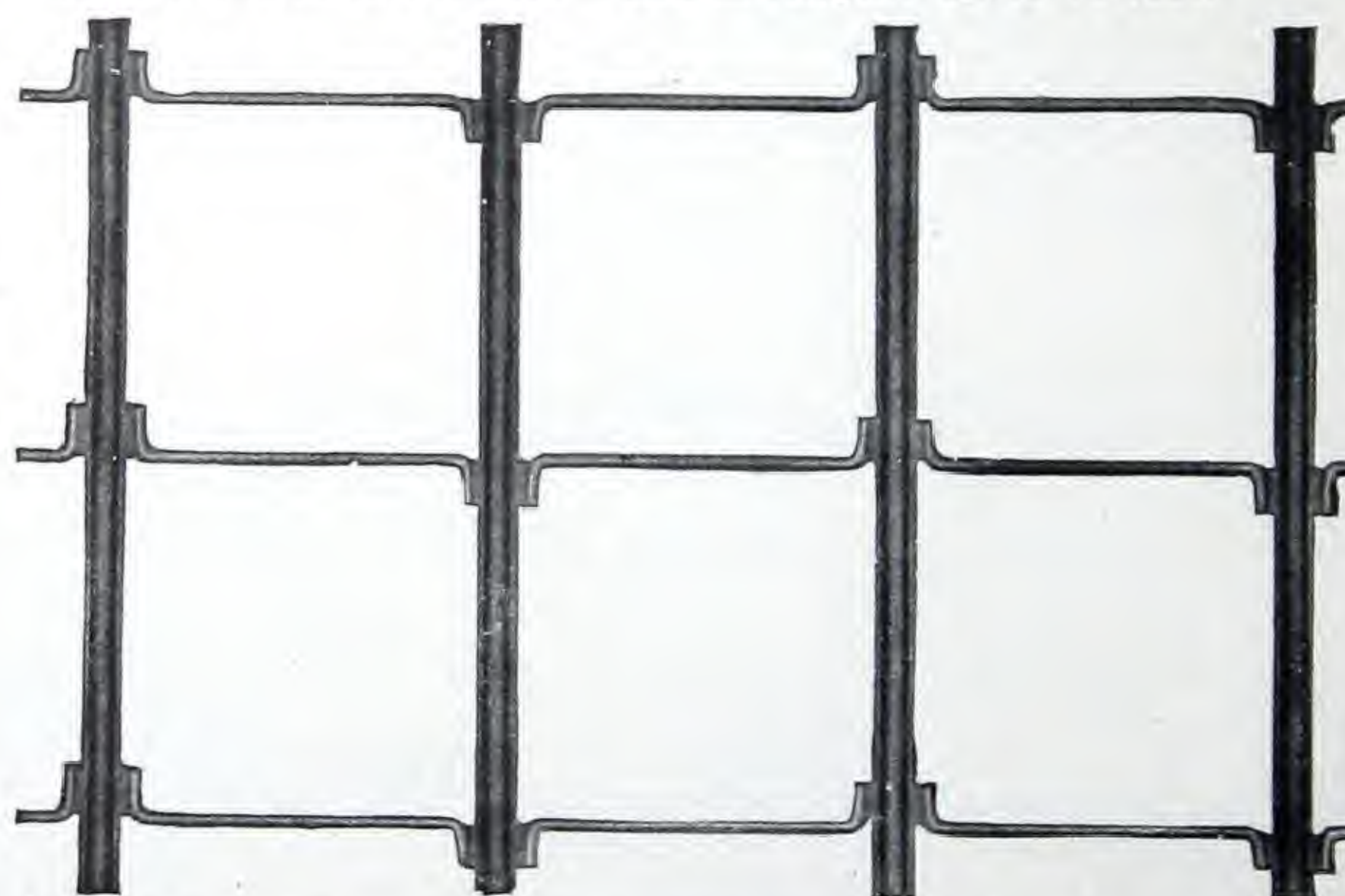
Rib Metal has the following advantages as a reinforcement for floor and roof slabs:

1. It is in the form of a mesh.
2. The main members span in the shortest straight line between the supports.
3. The main bars are accurately located and anchored in the concrete members.

Rib Metal is also supplied in curved sheets, the bending being done in our shops to any curve desired. This makes Rib Metal especially useful as a reinforcement for sewers and conduits.

Rib Metal is manufactured from medium open-hearth steel—the best for reinforcement.

Rib Metal is furnished in seven sizes of mesh—2-inch, 3-inch, 4-inch, 5-inch, 6-inch, 7-inch and 8-inch—and in lengths up to 18 feet.



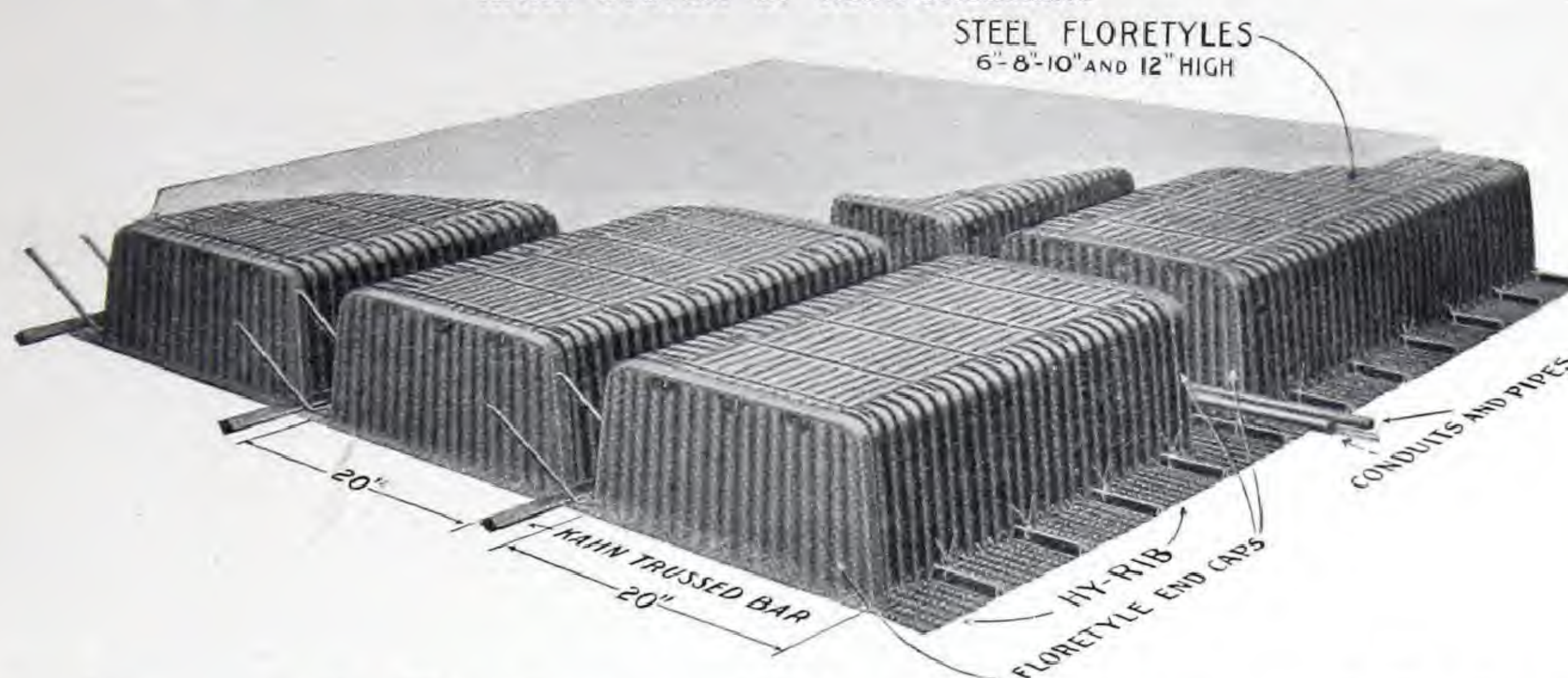
Ribbed
Metal
Steel
Mesh
Reinforce-
ment

Steel Floretiles

Steel Floretiles are deeply corrugated steel tiles open on the underside. The bends at the corners and the deep ribs on the top provide exceptional stiffness against deformation and great rigidity in supporting loads. The narrow reinforced concrete joists between the Floretiles carry the loads to the supports. Ends of Floretiles lap with a tight joint. Floretyle construction effects a great saving in concrete, steel, centering and weight. For flat ceilings, Hy-Rib is used on the underside. The bottom edges of the Floretiles are serrated to straddle the ribs of the Hy-Rib and engage in the

TRUSSED CONCRETE STEEL CO., LIMITED

KAHN SYSTEM OF REINFORCEMENT



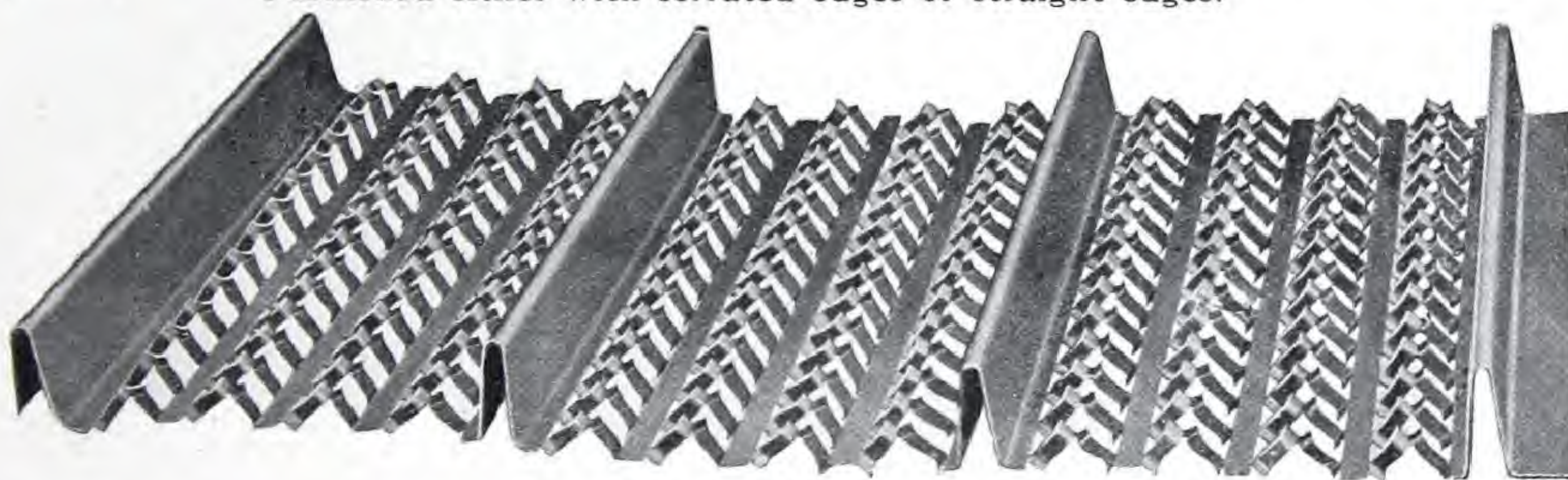
Steel Floretyles (Cont.)

mesh. Floretyles are used with one-way reinforcement and Floredomes with two-way reinforcement. Both possess the same marked advantages over terra cotta tile.

Rows of Floretyles are closed by means of End Tyles, 2 ft. long, or End Caps, fitting over the Floretyles.

Properties of Steel Floretyles

Depths: 6 in., 8 in., 10 in., and 12 in. Width at Base: 20 inches. Standard Lengths (nominal), 4 feet and 3 feet. Actual lengths are one inch greater, to allow for end lap of one corrugation. Furnished either with serrated edges or straight edges.



HY-RIB

Hy-Rib

Hy-Rib consists of a perfect steel lath surface stiffened by rigid high ribs. The ribs and the lath are manufactured from a single sheet of steel, making it a complete unit of lath and studs.

No centering is required where Hy-Rib is used in concrete floors and roofs, as the ribs give sufficient strength and rigidity. In walls and partitions Hy-Rib does away with the use of studs.

Uses for Hy-Rib are found in every field of building operation—in construction work of all kinds, Floors, Roofs, Walls, Partitions, Ceilings, and Furring. Curved Hy-Rib bent in our shops is used for Arched Floors, Culverts, Conduits, Sewers, Silos, Tanks, Reservoirs and Tunnels.

Hy-Rib is supplied in sheets 10½ and 24 inches wide, measured from centre to centre of the outside ribs. Endlaps of 2 inches should be allowed where splice is made over the supports, otherwise 8 inches. Ribs of Hy-Rib are 13-16 and 15-16 inches high and 3½ inches apart.

Standard lengths of sheets are 6 feet, 8 feet, 10 feet, and 12 feet. Intermediate and shorter lengths are cut from standard lengths. Waste in cutting is charged to purchaser.

Hy-Rib is furnished in three thicknesses of metal represented by United States Standard Gauges—No. 28, No. 26, and No. 24. Other gauges, as desired, can be supplied.

Cross sectional areas of Hy-Rib per foot of width including side laps: 28 Gauge, .165 square inches; 26 Gauge, .198 square inches; 24 Gauge, .264 square inches.

Information Booklets, or any further particulars on request.

STAR EXPANSION BOLTS

SEBCO PRODUCTS

J. EDWARD OGDEN, - Canadian Distributor

BRANCHES

H. F. McINTOSH & Co.
28 Toronto Street, Toronto

TURNER & WALKER
425 Henry Avenue, Winnipeg

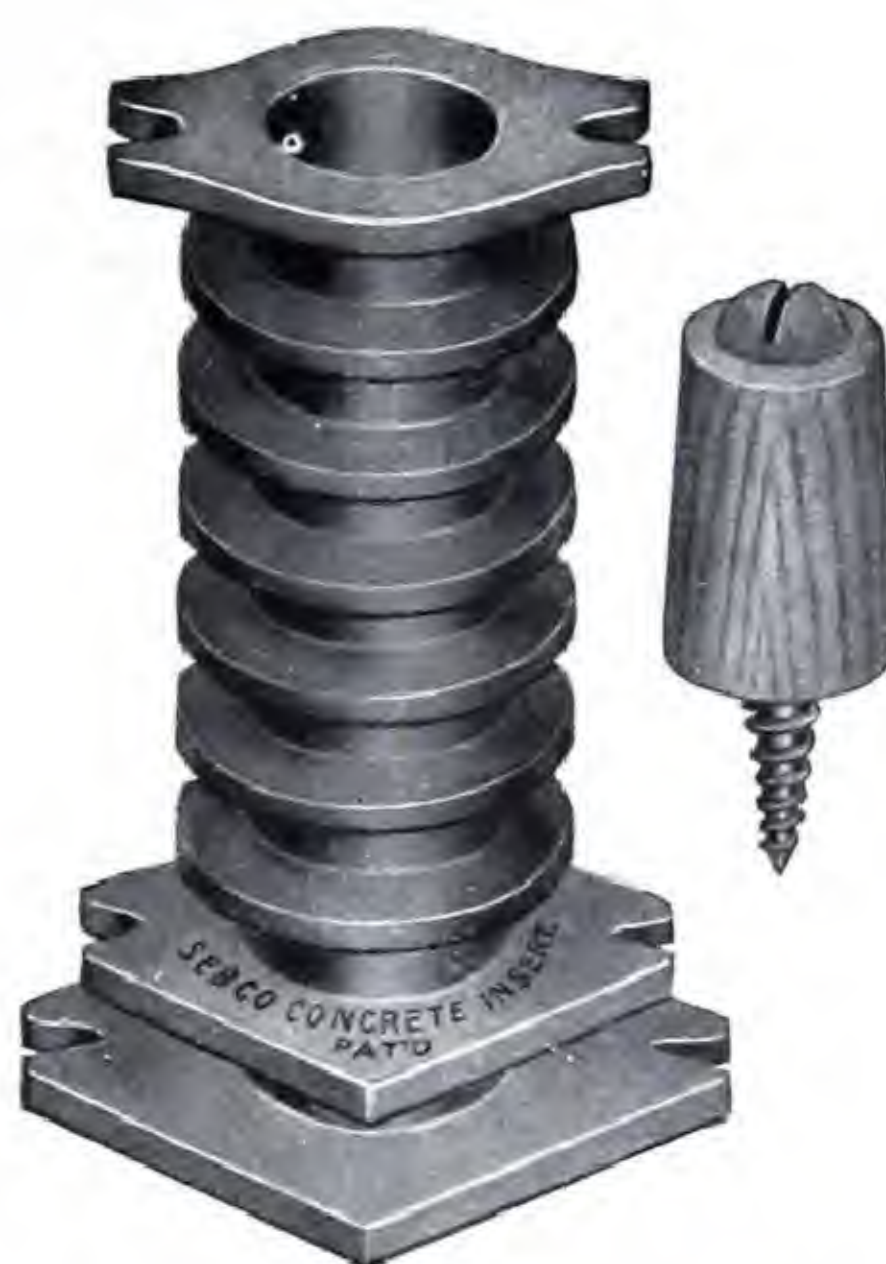
F. BACON & CO.
377 St. Paul Street, Montreal

- Products** Expansion Bolts of all kinds, Brick and Stone Drills, Screw Anchors, Toggle Bolts, Concrete Inserts, Pipe and Cable Clamps, Drills, Bridle Rings, allied lines and all devices for making fastenings. Special work made up promptly to specifications.
- Expansion Bolts** Our special line is the STAR Expansion Bolt, trade name SEBCO. It is commonly used for bolting iron or wood to masonry that is already built. A hole is drilled in the masonry of such size that the expansion shield will fit closely, and when the bolt is screwed up the shield expands and binds firmly in the masonry. For Heavy Work the Sebco Expansion Bolts are absolutely reliable—there is no better means of fastening iron railings, balconies, up-rights, partitions, etc., to walls of stone, brick, cement, etc.
- For Light Work** For light work the Sebco Screw Anchors are especially appropriate for fastening bathroom fixtures, electrical apparatus and any small objects to be attached to walls, floors, ceilings, etc., of any materials.
- Concrete Inserts** The new Sebco Insert used in concrete construction is made especially to meet the demand for a practical device to be used while pouring cement. Either lag screw or machine bolts may be used. They have been endorsed by hundreds of prominent architects and engineers for fastening fixtures to ceilings, floors, side walls, etc.
- Quality** Sebco Expansion Bolts are made of Malleable Iron, Non-rusting Composition, Brass and Bronze. All goods are standard and are specified by Government Engineers and the most prominent Architects.
- Specifying** Architects and Engineers find it advisable to specify Sebco Expansion Bolts and Screw Anchors for making fastenings of all kinds to Brick, Stone, Marble, Tile and Concrete. Bathroom and Toilet fittings in Hotels and Public Buildings are fastened securely and permanently only if Sebco Expansions are used. The same applies to fastening Opera Chairs and Church Pews to Concrete floors.

- Deliveries** Complete stocks are carried at Montreal, Toronto and Winnipeg, and immediate shipments can be made from these cities to all parts of Canada.
- Distribution** Sebco Products are carried by practically every Hardware, Electrical and Plumbing Jobber throughout the Dominion; and by dealers in every city of over 3,000 population.
- Samples, Etc.** Architects and Builders are welcome to samples of all our lines upon request. Send for our new catalogue and prices.
- Illustrations** The illustrations below give a fair idea of some of our products.



Sebco No. 1 Toggles



Sebco Concrete Insert



Fascut "Star" Drill



Sebco Screw Anchor



Sebco Expansion Bolt

Standard Method of Testing, and Specifications for Portland Cement of the Canadian Society of Civil Engineers

PORTLAND CEMENT.

1. **Definition.**—This term is applied to a hydraulic cementing material manufactured from approximately 1.7 parts of lime by weight, to 1 part of soluble silica alumina iron oxide, finely ground, intimately mixed, calcined to incipient fusion, and again finely ground. To this product not more than 3 per cent. of other material shall be added for particular purposes.

2. **Weight.**—Unpacked Portland cement weighs approximately 84 lbs. per cubic foot, and when hard packed, approximately 116 lbs. per cubic foot. One hundred pounds of cement should be considered as one cubic foot, as a basis of measurement for mixing mortar and concrete.

3. **Inspection.**—All cement shall be inspected, and at least 12 days shall be allowed for testing and inspection of the cement before it is used in the work.

4. **Testing.**—All tests should be made in accordance with the standard methods herein-after detailed, and should be made by an experienced person, having proper means for making the tests. When field tests give results which leave reasonable doubt as to the quality of the cement, it is recommended that samples be submitted for laboratory check tests, to an experienced tests of recognized ability and standing, before final acceptance or rejection under these specifications. Cement failing to meet the seven-day requirements may be held awaiting results of the 28-day tests.

5. **Storage.**—On all work where so demanded by the engineer, the contractor or other person in charge of the work, shall provide a suitable weather-tight building for the storage of cement, and the cement shall be stored in such a manner as to allow easy access for sampling and identification of each shipment.

6. **Packages.**—All cement shall be delivered in cement-tight packages, with the name of the manufacturer, the brand, and the net weight, plainly marked thereon.

SAMPLING.

7. **Selection of Sample.**—The selection of the sample for testing is a detail that must be left to the discretion of the engineer. The number and the quantity to be taken from each package will depend largely upon the importance of the work, the number of tests to be made, and the facilities for making them.

8. The sample shall be a fair average of the contents of the package; it is recommended that, where conditions permit, one package in every twenty-five be sampled.

9. Samples should be passed through a sieve having twenty meshes per lineal inch, in order to break up lumps and remove material.

This is also a very effective method for mixing them together in order to obtain an average. For determining the characteristics of a shipment of cement, the individual samples may be mixed and the average tested. Where time will permit, however, it is recommended that they be tested separately.

CHEMICAL ANALYSIS.

10. **Requirement.**—The cement shall contain not more than 4 per cent. of magnesia (MgO), nor more than 2 per cent. of anhydrous sulphuric acid (SO_3).

11. **Significance.**—Chemical analysis may render valuable service in the detection of adulteration of cement with considerable amounts of inert material, such as ground limestone. It is of use also in determining whether certain constituents, believed to be harmful when in excess of a certain percentage, as magnesia, and sulphuric anhydrid, are present in inadmissible proportions.

12. The determination of the principal constituents of cement (silica, alumina, iron oxide and lime) is not conclusive as an identification of quality. Faulty character of cement results more frequently from imperfect penetration of the raw material or defective burning than from incorrect proportions of the constituents. Cement made from very finely ground material, and thoroughly burned, may contain much more lime than the amount usually present, and still be perfectly sound. On the other hand, cements low in lime, may, on account of careless preparation of the raw material, be of dangerous character. Further, the ash of the fuel used in burning away may so greatly modify the composition of the product as largely to destroy the significance of the results of analysis.

13. **Method.**—The method to be followed for the analysis of cement shall be in accordance with that proposed by the Committee on Uniformity in Analysis of Materials for the Portland Cement industry, of the New York Section of the Society for Chemical Industry.

SPECIFIC GRAVITY.

14. **Requirement.**—The specific gravity of the cement, ignited at a low red heat, shall not be less than 3.10, and shall not show a loss on ignition of over 4 per cent.

15. **Significance.**—The specific gravity of cement is lowered by underburning, adulteration, and hydration, but the adulteration must be in considerable quantity to affect the results appreciably.

Inasmuch as the differences in specific gravity are usually very small, great care must be exercised in making the determination.

16. **Apparatus and Method.**—The determination of specific gravity is most conveniently

made with Le Chatelier's Apparatus. This consists of a flask of 120 cubic cm. (7.32 cubic in.) capacity, the neck of which is about 20 cm. (7.87 ins. long. In the middle of this neck is a bulb, and above and below the bulb are two marks, the volume between which is 20 cubic cm. (1.22 cubic in.). The neck has a diameter of about 9 mm. (0.35 in.), and is graduated into tenths of cubic centimeters above the upper mark.

17. Benzine (62 degrees Baume Naphtha), or kerosene free from water should be used in making the determination.

18. The specific gravity can be determined in two ways.

(a) The flask is filled with either of these liquids to the lower mark, and 64 gr. (2.25 oz.) of powder, cooled to the temperature of the liquid, is gradually introduced through the funnel (the stem of which extends into the flask at the top of the bulb) until the upper mark is reached. The difference in weight between the cement remaining and the original quantity (64 gr.) is the weight which has displaced 20 cubic cm.

(b) The whole quantity of the powder is introduced, and the level of the liquid rises to some division of the graduated neck. This reading, plus 20 cubic cm., is the volume displaced by 64 gr. of the powder.

The specific gravity is then obtained from the formula:

$$\text{Specific gravity} = \frac{\text{Weight of cement in grammes}}{\text{Displaced volume in cu. cm.}}$$

19. The flask, during the operation, is kept immersed in water in a jar, in order to avoid variations in the temperature of the liquid. The results should agree within 0.01. The determination of specific gravity should be made on the cement as received, and should it fall below 3.10, a second determination should be made on the sample, ignited at a low red heat.

20. A convenient method for cleaning the apparatus is as follows: The flask is inverted over a large vessel, preferably a glass jar, and shaken vertically until the liquid starts to flow freely. It is then held still in a vertical position until empty; the remaining traces of cement can be removed in a similar manner by pouring into the flask a small quantity of clear liquid and repeating the operation.

21. More accurate determination may be made with the pycnometer.

FINENESS.

22. **Requirement.**—It shall leave by weight a residue of not more than 8 per cent. on the No. 100 sieve, and not more than 25 per cent. on the No. 200 sieve.

23. **Significance.**—It is generally accepted that the coarser particles in cement are practically inert, and it is only the extremely fine powder that possesses adhesive or cementing qualities. The more finely cement is pulverized, all other conditions being the same, the more sand it will carry and produce a mortar of a given strength.

24. The degree of final pulverization which the cement receives at the place of manufac-

ture is ascertained by measuring the residue retained on certain sieves. Those known as the No. 100 and No. 200 sieves are recommended for this purpose.

25. **Apparatus.**—The sieves should be circular, about 20 cm. (7.87 inches) in diameter, 6 cm. (2.36 inches) high, and provided with a pan 5 cm. (1.97) inches deep, and a cover.

26. The wire cloth should be of brass wire having the following diameters:

No. 100—0.0045 inches.

No. 200—0.0024 inches.

27. This cloth should be mounted on the frames without distortion; the mesh should be regular in spacing, and be within the following limits:

No. 100—96 to 100 meshes to the lineal inch.

No. 200—188 to 200 meshes to the lineal inch.

28. Fifty gr. (1.76 oz.) or 100 gr. (3.52 oz.) should be used for the test, and dried at a temperature of 100 deg. Cent. (212 deg. Fahr.) prior to sieving.

29. The thoroughly dried and coarsely screened sample is weighed and placed on the No. 200 sieve, which, with pan and cover attached, is held in one hand in a slightly inclined position, and moved forward and backward, at the same time striking the pan gently with the palm of the other hand, at the rate of about 200 strokes per minute. The operation is continued until not more than one-tenth of one per cent. passes through after one minute of continuous sieving. The residue is weighed, then placed on the No. 100 sieve and the operation repeated. The work may be expedited by placing in the sieve a small quantity of large steel shot. The result should be reported to the nearest tenth of one per cent.

TIME OF SETTING.

30. **Requirement.**—It shall not develop initial set in less than thirty minutes, and must develop hard set in not less than one hour, nor more than ten hours.

31. **Significance.**—The object of this test is to determine the time which elapses from the moment the water is added until the paste ceases to be fluid and plastic (called the "initial set") and also the time required for it to acquire a certain degree of hardness (called the "final" or "hard set"). The former is the more important, since, with the commencement of setting, the process of crystallization or hardening is said to begin. As a disturbance of this process may produce a loss of strength, it is desirable to complete the operation of mixing and moulding, or incorporating the mortar into the work, before the cement begins to set.

32. It should be borne in mind that chemical action begins as soon as water is added to the cement, and that a very quick setting cement may be killed by prolonged mixing or disturbance, also that the time of setting may be greatly prolonged by gauging with excess of water and excessive working when preparing the test pat, and that if care is not taken in making the test, a dangerously quick setting cement may be wrongly accepted.

33. The time of setting is also materially

affected by temperature. Care should therefore be taken to have the room, cement, and gauging water as near to 70 deg. Fahr. before starting the test as possible. In damp weather the cement should be dried before weighing and gauging for setting test.

34. With a view to detecting dangerously quick setting cement, it is recommended that a definite percentage of water should be used in gauging, as follows: For a cement 75 per cent. of which will pass a No. 200 sieve, 22 per cent. of water, and an additional 1 per cent. of water, for each extra 5 per cent. of cement that will pass the No. 200 sieve.

35. In preparing pats for this test, mixing should be done on a non-absorbent surface, preferably plate glass. The dry cement should be carefully weighed, and placed on the glass with a crater formed, so that the water can all be placed in the centre. When adding the water, accurately note the time. Then with a small trowel mix the cement and water into a paste, working rapidly and thoroughly with the side of the trowel for a period of **one minute**. Form quickly into a ball with the hands and place on the glass, flattening down with the trowel into a circular pat about 3 in. diameter, $\frac{1}{2}$ in. thick in the centre, tapering to a thin edge (this pat may also be used for soundness test). The time from adding the water, to the finished pat, should not be less than 70 seconds, nor more than 80 seconds. Place a damp cloth over the pat, but not in contact with it. The cement shall be considered as having taken "initial set" when a wire $\frac{1}{12}$ in. diameter, loaded to weigh $\frac{1}{4}$ lb., shall leave a distinct mark on the pat, but not appreciably penetrate the surface, and the "final" or "hard set" when a wire $\frac{1}{24}$ in. diameter, loaded to weigh 1 lb., shall leave a distinct mark, but not appreciably penetrate the surface.

STANDARD SAND.

36. Natural sand* from Ottawa, Illinois, screened to pass a sieve having 20 meshes to the lineal inch, and retained on a screen having 30 meshes to the lineal inch, is recommended in preference to the standard quartz sand generally used.

37. For field tests, good sharp river or bank sand, screened to pass a sieve having 20 meshes to the lineal inch, and retained on a sieve having 30 meshes to the lineal inch, may be used. This sand should in all cases be washed clean before being used. As sand obtained in this way cannot be considered standard, results should be considered as approximate only.

MOULDS.

38. The moulds should be made of brass, bronze, or some other equally non-corrodible material, and made sufficiently rigid to prevent spreading during moulding of briquette. They may be either the gang pattern, or single.

39. The moulds should be kept clean, and wiped with an oily cloth before cement paste or mortar is placed in them.

MIXING AND MOULDING.

40. All proportions should be stated by weight. The quantity of water to be used should be stated as a percentage of the dry material.

41. The Metric System is recommended because of the convenient relation of the gramme and the cubic centimeter.

42. The temperature of the room and the mixing water should be as near 21 deg. Cent. (70 deg. Fahr.) as it is practicable to maintain it.

43. The sand and cement should be thoroughly mixed dry. The mixing should be done on some non-absorbing surface, preferably plate glass.

44. The quantity of material to be mixed at one time depends on the number of test pieces to be made; about 1,000 gr. (35.28 oz.) makes a convenient quantity to mix, especially by hand methods.

45. In making briquettes for tensile tests, use just sufficient water to make a stiff paste or mortar, which can be sufficiently well pressed into the moulds with the thumbs to make a dense briquette, and with just sufficient moisture on the surface to show bright when the briquette is troweled off.

46. A sand-glass is recommended as a convenient means of noting the time of mixing, and rubber gloves should be used when mixing with the hands.

47. Weigh the material and place on the mixing table, forming a crater in the centre, into which the proper percentage of clean water is to be poured. Add the water, carefully noting the time, or setting the sand-glass, then quickly turn the material from the outer edge into the crater with the aid of a trowel, thoroughly incorporating the water with the other material, taking one minute from the time of adding the water to perform this part of the work. Then complete the operation by vigorously kneading the mixture with the hands for an additional period of one and one-half minutes. Place carefully into the mould, pressing in firmly with the thumbs, heaping the mortar slightly above the mould. The trowel should then be drawn over the mould in such a manner as to exert a moderate pressure on the excess material. Reverse the mould, and trowel the other surface of the briquette in the same manner, leaving the surface truly level with the face of the mould.

48. A check upon uniformity of mixing and moulding is afforded by weighing the briquette just prior to immersion, or upon removal from the moist closet. Briquettes which may vary in weight more than 3 per cent. from the average should not be tested.

STORAGE OF TEST PIECES.

49. During the first 24 hours after moulding, the test pieces should be kept in moist air to prevent them from drying out.

50. A moist closet or chamber is so easily devised that the use of the damp cloth should be abandoned if possible. Covering the test pieces with a damp cloth is objectionable, as commonly used, because the cloth may dry out

unequally, and in consequence, the test pieces are not all maintained under the same condition. Where a moist closet is not available a cloth may be used, and kept uniformly wet by immersing the ends in water. It should be kept from direct contact with the test pieces by means of a wire screen or some similar arrangement.

51. A moist closet consists of a soapstone or slate box, or a metal-lined wooden box—the metal lining being covered with felt, and this felt being kept wet. The bottom of the box is so constructed as to hold water, and the sides are provided with cleats for holding glass shelves on which to place the briquettes. Care should be taken to keep the air in the closet uniformly moist.

52. After 24 hours in moist air the test pieces for longer periods of time should be immersed in water maintained as near 21 deg. Cent. (70 deg. Fahr.) as practicable. They may be stored in tanks or pans, which should be of non-corrodible material.

TENSILE STRENGTH.

53. **Requirement.**—The minimum requirements for tensile strength for briquettes one inch square in section shall be within the following limits, and shall show no retrogression in strength within the periods specified:

Neat Cement.

Age.	Strength.
24 hours in moist air	150-200 lbs.
7 days (1 day in moist air, 6 days in water)	450-550 lbs.
28 days (1 day in moist air, 27 days in water)	550-650 lbs.
One Part Cement, Three Parts Standard Sand.	
7 days (1 day in moist air, 6 days in water)	150-200 lbs.
28 days (1 day in moist air, 27 days in water)	200-300 lbs.

54. If the minimum strength is not specified the means of the above values will be taken as the minimum strength required.

55. The tests may be made on any standard machine. A solid metal clip is recommended. This clip is to be used without cushioning at the points of contact with the test specimen. The bearing at each point of contact should be $\frac{1}{4}$ in. wide, and the distance between the centre of contact on the same clip should be $1\frac{1}{4}$ in.

56. Test pieces should be broken as soon as they are removed from the water. Care should be observed in centering the briquette in the testing machine, as cross-strains produced by improper centering tend to lower the breaking strength. The load should not be applied too suddenly, as it may produce vibration, the shock from which often breaks the briquette before the ultimate strength is reached. Care must be taken that the clips and the sides of the briquette be clean from grains of sand or dirt, which would prevent

a good bearing. The load should be applied at the rate of 600 lbs. per minute. The average of not less than three briquettes of each sample tested should be taken as the test, excluding any results which are manifestly faulty.

CONSTANCY OF VOLUME.

57. **Significance.**—The object is to develop those qualities which tend to destroy the strength and durability of a cement. As it is highly essential to determine such qualities at once, tests of this character are, for the most part, made in a very short time, and are known, therefore, as accelerated tests. Failure is revealed by cracking, checking, swelling or disintegration, or all of these phenomena. A cement which remains perfectly sound is said to be of constant volume.

58. **Methods.**—Tests for constancy of volume are divided into two classes: (1) Normal tests, or those made in either air or water, maintained at about 21 deg. Cent. (70 deg. Fahr.), and (2) Accelerated tests or those made in air, steam or water at a temperature of 45 deg. Cent. (115 deg. Fahr.), and upward. The test pieces should be allowed to remain 24 hours in moist air before immersion in water or steam, or preservation in air.

59. For these tests, pats about $7\frac{1}{2}$ cm. (2.95 in.) in diameter, $1\frac{1}{4}$ cm. (0.49 ins.) thick at the centre, and tapering to a thin edge should be made upon a clean glass plate about 10 cm. (3.94 ins.) square. These pats are to be prepared in the same manner and with the same percentage of water as pats for setting tests.

60. **Normal Test.**—A pat is immersed in water maintained as near to 21 deg. Cent. (70 deg. Fahr.) as possible for 28 days, and observed at intervals. A similar pat after 24 hours in moist air is maintained in air at ordinary temperature and observed at intervals.

61. **Accelerated Test.**—A pat is exposed in any convenient way in an atmosphere of steam, above boiling water in a loosely closed vessel for five hours. The apparatus recommended by the Committee of the American Society of Civil Engineer for making these determinations, is also recommended by your Committee.

62. To pass these tests satisfactorily the pats should remain firm and hard, and show no signs of cracking, distortion or disintegration.

Should the pat leave the plate, distortion may be detected best with a straight-edge applied to the surface which was in contact with the plate.

64. In the present state of our knowledge it cannot be said that cement should necessarily be condemned simply for failure to pass the accelerated tests, nor can a cement be considered entirely satisfactory, simply because it has passed these tests.

WATERPROOF CEMENT

WATERPROOFING CONCRETE WORK.

In General.—Water-tightness shall be secured by surfacing with an unbroken continuous coat of cement mortar to which an approved waterproofing compound has been added. The compound, as manufactured by _____, or its equal, may be used for waterproofing the cement or imparting to the latter its water-repelling properties. The waterproof cement mortar coating shall be prepared as follows.

Preparation of the Coating.—A high-grade Portland cement, passing all the usual requirements as to strength, soundness, etc., shall be used. To each bag of cement there shall be added dry the waterproof compound called for above, exact proportion or percentage being as directed by the manufacturer. The cement and compound must be manipulated until a homogeneous mixture in every respect is obtained.

The cement thus waterproofed shall be in the proportion of one part cement to two parts of sand. The sand shall be absolutely clean, containing no loam or foreign matter, and well graded from coarse to fine. The sand need not be sharp. The sand is to be moistened, waterproof cement spread over it, and the whole manipulated until a homogeneous waterproof coating mortar is obtained. This material is to be made in small quantities and used fresh.

Under no circumstances shall the compound be added after the cement has partially set or has been mixed with sand.

Drenching Surfaces.—Just before the main mortar coating is to be applied, the chipped and wire-broomed walls shall be thoroughly drenched and soaked to its full absorbing capacity.

Slush Coating.—Before the wall shows signs of drying, a "slush coating" shall be applied. To prepare this, some of the mixed, ready-for-use coating shall be thinned with water to the consistency of cream. It shall be applied with a palmetto, or an equally strong-fibered scrubbing brush, with a scouring effect, care to be exercised to fully cover, in this manner, the inner surfaces of all crevices and holes.

Scratch Coat.—Before the slush coating has dried, the first application of the regularly mixed coating shall be applied as a scratch coat, from one-fourth to three-eighths inch thick, and pressure brought on the trowel to push the coating on, to form a uniform bearing.

The scratch coat shall be trowelled to a fairly good surface and scratched before hardening.

Finishing Coat.—Upon the scratch coat, before its final setting, the finishing coat of sufficient thickness to obtain a total thickness of five-eighths inch shall be applied.

This shall be pushed on hard and uniformly trowelled and floated to a true surface, free from pits, pin holes, sagging cracks, projections or other defects. The floating of the finished surface shall be done from the bottom of the wall up. Special care must be exercised to apply this finish coat before the first coat has reached its final set.

The composition of the finished coating shall be one part of waterproofed cement to two parts of sand, well graded and previously moistened.

In General.—The application of alternate coatings of soap and alum solutions shall be applied to the surface of walls intended to be waterproof.

Proportions.—The process shall consist in applying first a solution of three-quarters ($\frac{3}{4}$) of a pound of soap to one (1) gallon of water, followed, after twenty-four hours, by the application of a solution containing two (2) ounces of alum to one (1) gallon of water. The soap and alum shall each be perfectly dissolved before using. The proportions may be varied if better results are thereby secured.

Application of Coatings.—Both solutions shall be applied with a flat brush, the soap solution boiling hot, and the alum solution at 60 degrees to 70 degrees F. The first coat shall remain on twenty-four hours, or until it is dry and hard. Alum solution, second coat to be applied thoroughly over the first coat. Second coat shall remain twenty-four hours before third coat (soap solution) is put on. These washes shall be applied with a soft brush.

Number of Washes.—Two or more washes of each solution shall be applied, depending upon exposure, pressure and other local conditions.

Frothing.—Care shall be taken to avoid frothing in applying the soap wash.

Temperature of Air.—Temperature of air shall not be less than 50 degrees F. at the time of application of the washes.

Condition of the Surface.—The surfaces shall be clean and dry before applying any of the washes.

INTRODUCTION OF FOREIGN INGREDIENTS

In General.—Concrete may be waterproofed by mixing with the cement some form of waterproofing compound of proved efficiency.

Waterproofing Paste.—Water-tightness shall be secured by the addition of Waterproofing Paste, as manufactured by _____, to all water used to temper the dry mixture of cement and aggregate in proportions, and mixed as directed below.

Waterproofing Powder.—Water-tightness shall be secured by proportioning the ingredients of the concrete so that the voids in the

same shall be reduced to the minimum as far as practicable in accordance with the foregoing specifications, and by the addition to the cement of a dry powdered waterproofing compound.

Sand for concrete should be had hard and clean and should have grains grading in size from $\frac{1}{4}$ -inch down. Pit and stream sands are generally of good quality, but drift sand is usually too fine of grain to make good concrete. The presence of dirt can easily be ascertained by pouring a small quantity of sand into a pail of clear water or by rubbing a portion between the palms of the hands. A practical test may be made by placing a four-inch depth of sand in a fruit-jar, and by adding water until the jar is within one inch of full, and by shaking the contents vigorously. If, after the water has again become clear, there is a layer or mud more than one-fourth inch in thickness, the sand should not be used without first washing.

The most suitable stone for crushed rock is one which is clean, hard, breaks with sharp angles, and to which mortar easily adheres. Trap, granite and hard limestone are among the best. The use of shale, slate and very soft limestones and sandstones should be avoided. The crushed rock should be screened only sufficiently to remove the fine dust. The maximum size of stone allowable is often dependent upon the thickness of the object to be molded. It is common practice to fix the extreme limit at $1\frac{1}{4}$ inch in diameter.

Bank-run gravel, just as dug from the pit or taken from the stream bed, seldom runs even, and rarely has the proper proportions of sand and pebbles for making the best concrete. An ideal pit gravel is 40 per cent. sand. Since there is generally too much sand in proportion to the pebbles, it is advisable and economical to screen the sand from the pebbles and then to remix them in the correct proportions. As a general rule, pebbles larger than $1\frac{1}{4}$ inch in diameter are discarded; all material smaller than $\frac{1}{4}$ inch is considered sand. Gravel should contain no rotten stone and should be clean.

Depending on the character of the particles, sand, crushed rock and gravel vary in weight from 100 to 110 pounds per cubic foot.

For fire-proofing and for various other purposes requiring low stresses, cinder concrete is frequently used. The cinder should consist of hard, clean, vitreous clinker free from sulphides, unburned coal and ashes. A clean cinder will not discolor the palms of the hands when rubbed between them.

The water used in mixing the concrete should be clean and free from oil, alkali and vegetable matter.

PROPORTIONING AND MIXING.

The proper proportion for combining the Portland cement and the aggregate is dependent upon the quality and character of the materials and the purpose for which the resulting concrete is intended. For reinforced and damp-proof concrete, that proportion is desirable which produces the densest concrete possible. Under other conditions only sufficient cement is used to develop the strength required for the concrete. For reinforced and damp-proof concrete, a 1-2-4 mix is commonly employed. Where compressive strength alone is a requisite, the concrete is frequently proportioned 1:2½:5. For massive foundations, a 1:3:6 concrete may be used. In such proportions, the first numerical term refers to the parts of Portland cement, the second to the parts of sand, and the third to the parts of crushed rock, screened gravel, or other coarse aggregate. The proportions are based on measurements by volume in which a bag of cement is considered one cubic foot. If pit gravel is used, although the saving in cement will usually more than compensate the cost of screening and remixing, similar proportions are adopted in which the second or sand term is dropped. Such proportions then read 1:4, 1:5 and 1:6. Cinder concrete is usually made in the proportion 1 part cement to 2½ parts sand to 5 parts cinders. On large work, and where the determination of the exactly correct proportions is expedient, the voids in the sand and stone are determined by saturation with water or by specific gravity. With the proportion of voids thus carefully ascertained, there is generally used an excess of 5 to 10 per cent. of cement over the voids in the sand, and a 5 per cent. excess of sand over the voids in the stone.

In making a batch of concrete, the amount of each material required should be actually measured by volume, otherwise concrete entirely homogeneous in texture and appearance cannot well be produced. Since a bag of Portland cement (loose) is equivalent to one cubic foot, for convenience all measurements should be based on the cubic foot as the unit. As a means of measuring, a bottomless box, or a device equally exact, should be employed. The sizes of measuring boxes are dependent upon the amount of concrete to be mixed in each batch.

Kind of Concrete Mixer.	Proportions by parts.			Materials.				Two Bag Batch.		Water in gallons for medium wet mixture. Gallons.
	Cement	Sand	Stone or Gravel.	Cement, Bags	Sand, Cubic feet	Stone or Gravel, Cubic ft.	Concrete, Cubic ft.	Size of measuring boxes. Inside measurement.		
								Sand.	Stone or Gravel.	
1 : 2 : 4 Concrete.....	1	2	4	2	3 $\frac{3}{4}$	7 $\frac{1}{2}$	8 $\frac{1}{2}$	... 2' x 2' 11 $\frac{1}{2}$ "	2' x 4' 11 $\frac{1}{2}$ "	... 1
1 : 2 $\frac{1}{2}$: 5 Concrete ..	1	2 $\frac{1}{2}$	5	2	4 $\frac{3}{4}$	9 $\frac{1}{2}$	10	... 2' x 2 $\frac{1}{2}$ ' 11 $\frac{1}{2}$ "	2' x 5' 11 $\frac{1}{2}$ "	... 12 $\frac{1}{2}$
1 : 3 : 6 Concrete.....	1	3	6	2	5 $\frac{3}{4}$	11 $\frac{1}{2}$	12	... 2' x 3' 11 $\frac{1}{2}$ "	2' x 6' 11 $\frac{1}{2}$ "	... 13 $\frac{1}{2}$

CANADA CEMENT COMPANY LIMITED

HEAD OFFICE: MONTREAL

Sales Offices:

MONTREAL

TORONTO

WINNIPEG

CALGARY

Product **CANADA Portland CEMENT.**

Quality Users of **CANADA Portland CEMENT** can rest assured of successful concrete work. The reputation of **CANADA Portland CEMENT** for uniform setting, rapid hardening, and thoroughly satisfactory performance of all duties expected of high-grade Portland Cement, is due to the scrupulous care used in its manufacture, with the additional safeguard of rigid inspection by expert chemists. **CANADA Portland CEMENT** is guaranteed to pass the tests of the Canadian and American Societies of Civil Engineers.

Mills The location of our twelve mills, near important centres of population, where railroad facilities are best, enables us to give the quickest possible delivery at minimum prices. These mills are at Montreal and Hull, Que.; Port Colborne, Belleville, Marlbank, Shallow Lake and Lakefield, Ont.; Winnipeg, Man.; Calgary and Exshaw, Alta.

ALFRED ROGERS, LIMITED

28 King St. West

Toronto, Ont.

"PORTLAND CEMENT"

Our Brands

The brands we manufacture are
St. Marys, Saugeen, Stirling,
Doric.

Our Factories

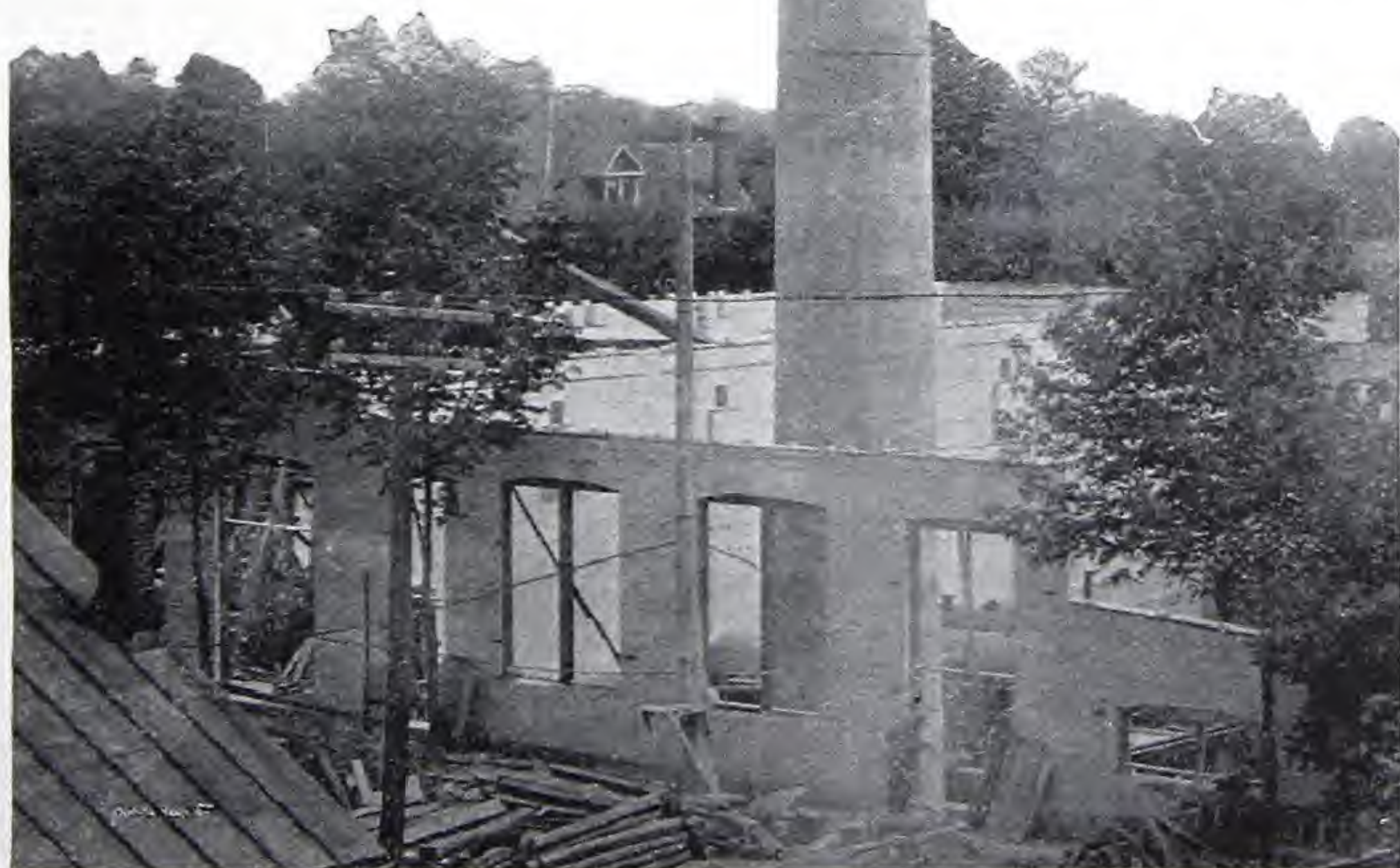
Our factories are situated at
Hanover, Kirkfield, and
Owen Sound, St. Marys.

Tests

In endeavoring to maintain the
highest Standard of efficiency
throughout the entire manufac-
ture of our cement we have
succeeded in establishing a re-
putation for reliability among
the users of cement who do not
have the time or opportunity to
test each shipment and who
consequently rely upon the
Manufacturer.

"Roger Cement"

Perfect
in
Color
and
Analysis
Best
by
Test



Cement
Chimney
Built for
The Dominion
Canners
by
Weber Chimney
Co.,
of Chicago

Continued on next page



Dam at Bracebridge, Ont. Contractor—W. G. Gibson, Port Hope

BECOMES HARDER AS IT GROWS OLDER

Rogers Cement

Is especially adapted to making concrete and can be relied on to attain great strength, uniformity and become harder year after year.



Farm Bridge for Walk on Roadway

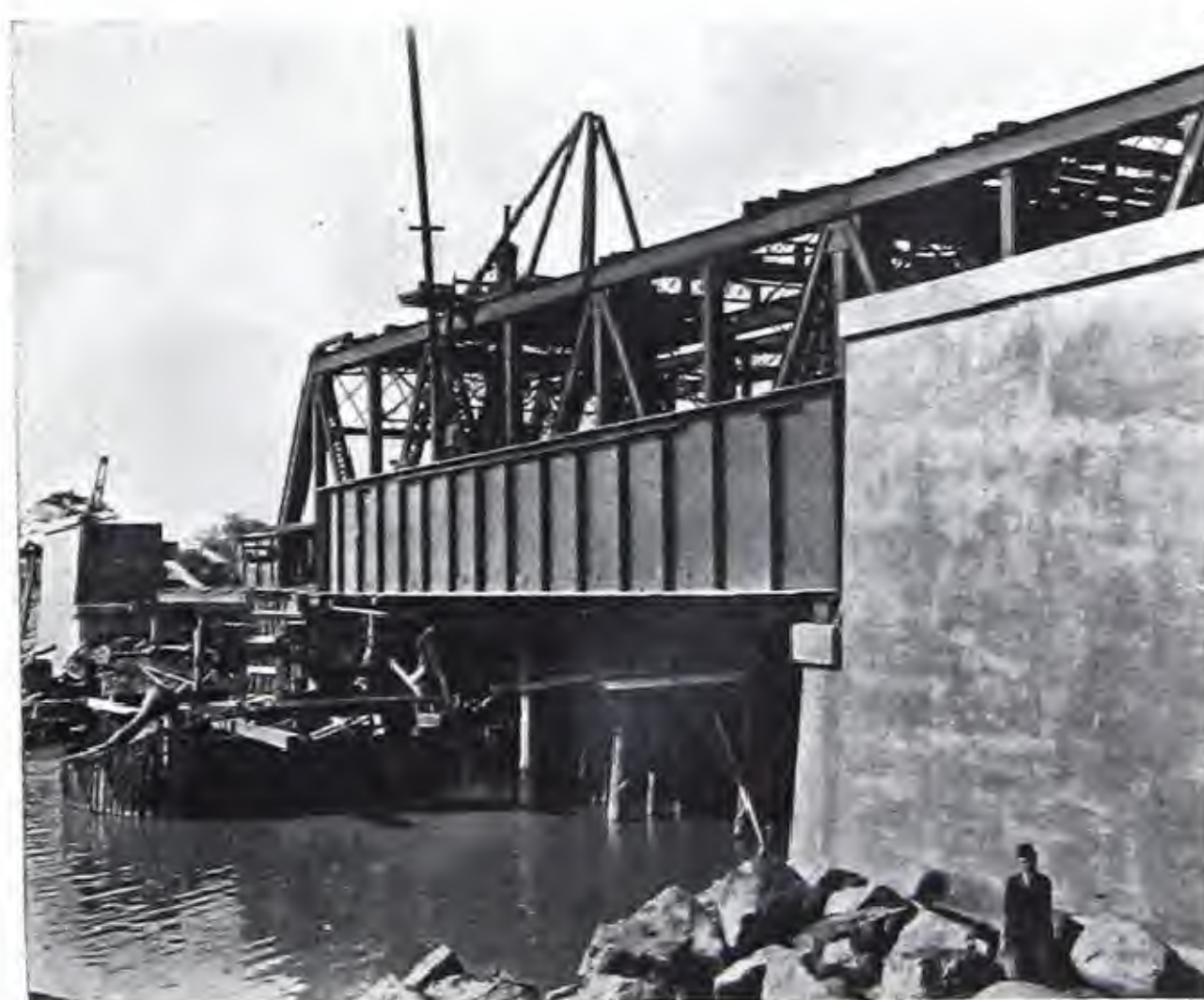
Continued on next page



Bridge over Don River, Queen Street, Toronto

Facilities Our factories are equipped with the most modern improvement, have a large capacity and good storage which enables us to ship all orders promptly.

Our mills are situated so as to have every possible advantage of railway and water connection. We are in a particularly good position to ship to Ontario and all the Western Provinces.



G.T.R. Bridge. (High Level), Sunnyside, Toronto

Adaptability Our cement is adapted for all uses and purposes where a high grade cement is desired such as in foundations, bridgepiers, artificial stone, floors, tunnel work and wherever a strong and uniform concrete is necessary.



C.P.R. Bridge over G.T.R. Railway, Port Hope, Ont. Contractor—W. G. Gibson, Port Hope

Packages Every precaution possible is taken to provide the highest character packages.



A cut of 10,000 Hydro Electric Poles in which our Cement was used

Illustrations These cuts illustrate a few of the structures where our cement was exclusively used, they also show the wide range and adaptability of Cement.

Information We will gladly furnish Architects and Engineers any further information required and will co-operate with them in any tests they wish to make on our Cement.

SAND & SUPPLIES LIMITED

Head Office:
T O R O N T O

Plants:
TORONTO AYR., ONTARIO HAGERSVILLE

Products Screened Gravel and Sand.
 Water-Washed Sand. Pit Run.
 Crushed Lime Stone. Crushed Granite.

Specialties Screened Gravel, for all classes of concrete work, taking the place of crushed stone at lower cost to consumer. Screened Sand especially adapted for Concrete. Water-Washed Sand, being high in silica is suitable for core making, plastering, marble and glass polishing. Lime stone, "Hagersville," is specially suited for high grade road building.

Location Our gravel plant is situated on the main line of the C.P.R., Ayr., Ont., and has a capacity of 1200 tons per day.

**Corres-
pondence** A post-card addressed to our head office will bring you any information regarding our commodities, delivery and prices.

HERCULES WATERPROOF CEMENT CO.

Manufacturers of
"HERCULES"
WATERPROOFING
AND
STRENGTHENING
COMPOUNDS



Distributors in:—
Montreal, Ottawa,
Toronto,
Hamilton, Welland,
Niagara Falls,
London and Winnipeg

Office - - 705 MUTUAL LIFE BLDG., BUFFALO, NEW YORK

Products POWDER, PASTE and LIQUID FORMS of WATERPROOFINGS for Cement Mortar and Concrete; COLORED COATINGS and ENAMELS; WATERPROOF CEMENT.

Specifications, Powder Form "Hercules" Waterproofing and Strengthening Compound in Powder Form shall be used in the aggregate of all concrete construction where waterproofing is required according to plans and specifications. Two per cent. of "Hercules" (equal to two pounds of "Hercules" to each bag of cement) shall be thoroughly mixed with all Portland Cement which is used in the aggregate. The "Hercules" and cement are to be mixed before the addition of sand and water.

Specifications, Plaster Coat "Hercules" Waterproofing and Strengthening Compound in Powder Form shall be used in all plaster cement finish, which finish shall be from one-half to three-quarter inch thick for outside walls; three-quarter to one inch thick for inside walls, and one inch to one and one-half inches thick for floor surfaces. All cement used in the plaster coat shall be waterproofed by the incorporation of "Hercules" Powder in the ratio of three pounds "Hercules" to each bag of cement, and the cement so treated shall be mixed with two parts sand, and by the addition of water made into a mortar of the consistency of a soft putty. Apply such mortar to (scarred and dampened) surfaces with as much arm pressure as possible, and trowel smooth. To secure a perfect bond between the construction and plaster, the erected construction shall be thoroughly clean and damp when the waterproofing mortar is applied. If the waterproof plaster coat is applied to new concrete construction, the application is to be made as soon after the removal of the forms as possible, and under no circumstances later than twenty-four hours, unless the walls are re-dampened.

Specifications, Paste Form "Hercules" Waterproofing Compound in Paste Form shall be mixed in the ratio of one gallon paste (approximately nine pounds) to each fifteen gallons of gauge water. Only the water so treated shall be used in mixing the concrete for such work where "Waterproofed Concrete" is specified and required according to plans and specifications.

Specifications, Liquid Form "Hercules" Waterproofing in Liquid Form shall be applied to erected concrete, brick, stucco and cement surfaces exposed to atmospheric dampness and moisture. This colorless fluid shall be applied to surfaces while they are dry and clean. Two coats shall be given the surfaces with a soft brush, slowly, the second coat about six hours after the first. Not less than one gallon to be used to each 150 square feet of surface (one coat).

Colored Coatings and Enamels for Cement Yellow, Gray, Slate, Green, Red, White (special colors made to order), are used just as found in the container, after being thoroughly stirred. The surface to which the coatings are applied to be dry and clean. Application made with a wide flowing-out brush, keeping the brush full of paint and brushing only enough to settle into place. The coatings dry to touch very soon, but harden in the course of several days to a final extremely hard surface.

STINSON-REEB BUILDERS' SUPPLY COMPANY, LIMITED**Read Building, 45 Alexander Street****MONTREAL - P. Q.**

Product "Medusa" Waterproofing Compound.

Tests We recently received report from the Canadian Inspection and Testing Laboratories, made on "Medusa," remarkable alike for its severity and success, stamping this material as the most reliable on the market.

The tests for tensile strength, absorption and effect on setting of concrete have all been borne out under actual field and working conditions.

Description "Medusa" is a dry white powder, ground to a consistency finer than cement, and for use is mixed with dry Cement to insure thorough and uniform incorporation before water is added.

2% by weight of neat cement is generally used under condition of water pressure. This may vary to 1½% under ordinary condition.

Estimating For estimate purposes figure 8½ pounds per cubic yard of concrete.

References A list of some of the more important works in Canada where Medusa has been used are as follows:—MacDonald Hotel, Edmonton, Alta.; Qu'Appelle Hotel, Regina, Sask.; Fort Garry Hotel, Winnipeg, Man., for which works Ross & MacDonald were Architects; Public Market, Maisonneuve; Montreal Harbour Commissioners Elevator No. 2; Dandurand Building, Wesleyan College, Power Building, Montreal.

Further Information We will furnish, on request, free samples, quantity estimates, prices, specifications, tests, etc.

CONCRETE MACHINERY

CEMENT MIXERS.

An effective concrete mixer not only stirs the mass, which may tend to separate the light and heavy particles, but cuts it again and again, and repeatedly transfers the materials from one part of the machine to another, so that in whatever order they are introduced, the product will be homogeneous. Continuous turning alone does not accomplish the result so quickly or thoroughly as the more complicated motions. The appearance of the concrete as it falls from the mixer will often distinguish the better of two machines.

The larger the machine, the more economical it will be, provided the arrangements for supplying it with material and conveying the concrete to the work permit running at full capacity.

Concrete mixers are of two general classes: (1) Continuous mixers, into which the materials are fed constantly, usually by shovelfuls, and from which the concrete is discharged in a steady mass, and (2) batch mixers, designed to receive at one charge, say, a barrel or a bag of cement, with its proportionate volume of sand and stone, and after mixing to discharge it in one mass. It is impossible to separate these two classes very distinctly, because many of the machines are adapted to either continuous or batch mixing.

Engineers are opposed, as a rule, to the use of continuous mixers in reinforced concrete work, unless the machine is provided with a mechanical batch feed hopper, because of the difficulty of uniform feeding. With batch mixers all the materials enter the machine at once; the homogeneity of the product depends upon the character and length of time of mixing rather than upon the care exercised by the laborers in feeding, and less inspection is necessary as a rule.

The selection of the type of mixer is often governed by local conditions. If, for example, there is to be a large quantity of concrete and the machinery can be located at one place, a stationary machine, mounted perhaps on timber framework, with derricks, elevators or belts, to raise the materials, may be economical. On running work, like a conduit or retaining wall, more portable machines are required; while for thin layers, like pavement foundations, if any machine is used it must be very light or easily moved. If stone for the aggregate is to be broken on the spot, a stationary plant may be built, or the stone may be hauled from the crusher bin to the mixer. In some cases the conformation of the ground will permit of dropping the materials into or through the machine by gravity. Frequently the volume of concrete to be laid is limited by the construction of forms, and a machine of small size is sufficient.

TYPES OF MIXERS.

Mixers may be classified in three general types:—

Rotating mixers.

Paddle mixers.

Gravity mixers.

Rotating or rotary mixers, as they are usually termed, sometimes mix the materials by simply tumbling them in an oblong or cubical box, and in other cases by throwing them against deflectors, blades or plows.

The cubical box is one of the simplest forms of rotating mixers, and formerly was used largely on extensive concrete construction, but is now giving place to modified forms which permit more thorough mixing and the inspection of the material during mixing.

The rotating mixers which contain deflectors, or blades, are usually mounted by the manufacturers upon a suitable frame, although in certain cases it is preferable to construct special timber framework, so that materials may be introduced and the concrete taken away more economically. The larger machines of this type are so constructed that the materials can be introduced from derrick buckets, carts, or barrows. The rotating of the drum tumbles the material, and also throws it against the mixing blades, which cut and throw it from side to side. Most of these machines can be dumped while running, by tilting either them or their chutes. They are also provided with hoppers, or with loading skips or trays, operated by the engine that runs the mixer, which lift the materials from the ground up to the charging hopper.

Of the paddle mixers, those adapted to mix a batch at a time can be more surely depended upon to produce good concrete than the continuous machines. Generally, the mixing paddles, on two shafts, revolve in opposite directions, and the concrete falls through a trap door in the bottom of the machine into carts, cars, or wheelbarrows, or upon a platform, whence it is shoveled into place.

The continuous paddle mixer with a single shaft, and an open end, is sometimes used for a volume of concrete ranging from 75 to 150 cubic yards per day. Care should be taken that the materials are thrown in near enough the upper end to be thoroughly mixed. The water is usually fed near the middle of the machine, so that the materials are first partially mixed dry. They may be measured by shovelfuls, or by spreading in layers before shoveling into the mixer, or by automatic machinery, which feeds the cement and each aggregate, in the proper proportions.

Most mixers of this type are now provided with mechanically operated batch feed hoppers.

PROPORTIONS.

In framing concrete specifications, the proportions of the constituents should be stated so distinctly that there can be no misunderstanding between the engineer and the contractor as to the quantities which will be required for the work. The quantity of cement should invariably be regulated by its weight; if the proportions are stated by volume a definite weight or number of packages of cement must be assumed to the unit volume. It is also more accurate and scientific to measure the aggregates by weight than by volume, and since with a properly constructed plant using materials of several sizes, the cost need be no more than volume measure, this likely will eventually become common practice in the case of important construction.

With our present system of weights and measures, it is advisable either to specify the number of cubic feet (or pounds) of sand and gravel, stone, or mixed material to a definite weight of cement, or else to stipulate a definite weight of cement to a cubic yard of concrete tamped in place, with an aggregate of clearly described material proportioned as the engineer may direct.

In stating the proportions for both mortar and concrete, it is now customary to separate the materials by colons, the first figure always representing the cement, followed by the aggregates in the order of the size of their grains. For example, 1:3:6 means 1 part cement (the unit of measurement should be stated), 3 parts sand, and 6 parts coarse material; or 1:8 means 1 part cement (of defined weight) to 8 parts of graded aggregate. Mortar in proportion 1:2 signifies one part cement to two parts sand, by either weight or volume, as specified.

Concrete mixing is seemingly so simple an

operation that it is often neglected by the inspector, and poor workmanship escapes detection.

The inspector should lay the greatest stress upon exact measurement of the sand, gravel or broken stone, thorough mixture of the mass and care in dumping the concrete into place. The quantity of water used in the mixing and the proper ramming or puddling of the concrete in place are equally important, but are less likely to be overlooked.

In proportioning the ingredients, it is poor economy to make allowance for insufficient mixing or improper handling of the materials. The additional cement will be much more expensive than the extra time expended in securing a homogeneous mixture.

MECHANICAL FEATURES.

The following are a few of the desirable mechanical features of concrete mixers. The most important consideration is a design such that the machine can be relied upon to thoroughly mix its contents, and when supplied with materials in the proper proportions turn out homogeneous concrete. Mixers should be so designed that "overloading" is impossible, or at least difficult, as this tends to poor mixing. They should be such that material can be fed into and taken away from the mixer with as small an amount of labor and staging as possible. In addition to the above considerations of design, the mixer should be economical of power, strong, durable, easy to repair or replace worn parts, quiet in operation (unloaded), for noise means poor design or workmanship and wear. The bearings should be well protected from dust and dirt, and effectively oiled. Reasonable protection should be given the moving parts to prevent the men from injury, or the machine, in case lumber, or tools, etc., are dropped on it.

WETTLAUER BROS.

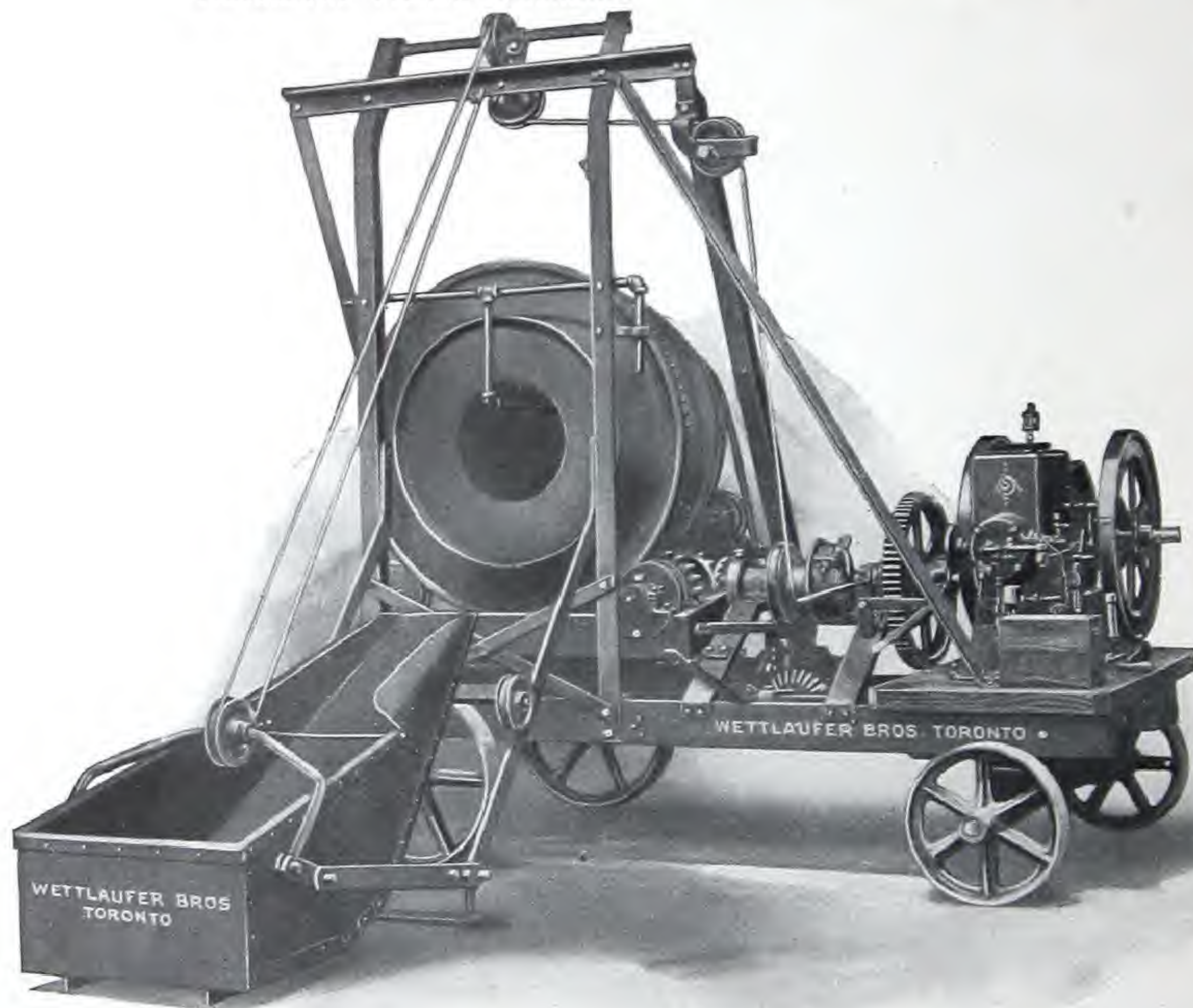
HEAD OFFICE

178 Spadina Ave.

Toronto, Ont.

BUFFALO, N.Y. DETROIT, MICH. STRATFORD, ONT. MITCHELL, ONT.

Products Concrete, Paving, Standard, Continuous, and Hand Mixers.
 Gasoline, Electric and Steam Hoists.
 Power Press Brick Machines, Hand Brick Machines.
 Mounted and Stationary Crushers.
 Elevators, Belt Conveyors, Revolving Screens, Gasoline and Steam Engines,
 Tile and Block Machines, Motors, Boilers, Sidewalk Tools, Tile and
 Brick Cars.
 Diaphram, Centrifical and Steam Pumps, "Contractors Supplies."
 Gravel Loaders, Steam Shovel, Traction Paving Mixers, Dumping Cars,
 Automatic Trench Machines.



**Wettlaufer
Heart-
Shaped
Mixers**

Advantages

These famous Mixers are recommended by all the leading Engineers and Contractors because of the ability of "Wettlaufer" Heart-Shaped Mixers to cover every possible condition in the Handling and Mixing of Cement material.

Automatically controlled by one man in one position. Automatic Dump, Automatic Lift Hopper, Steel and Semi-Steel.

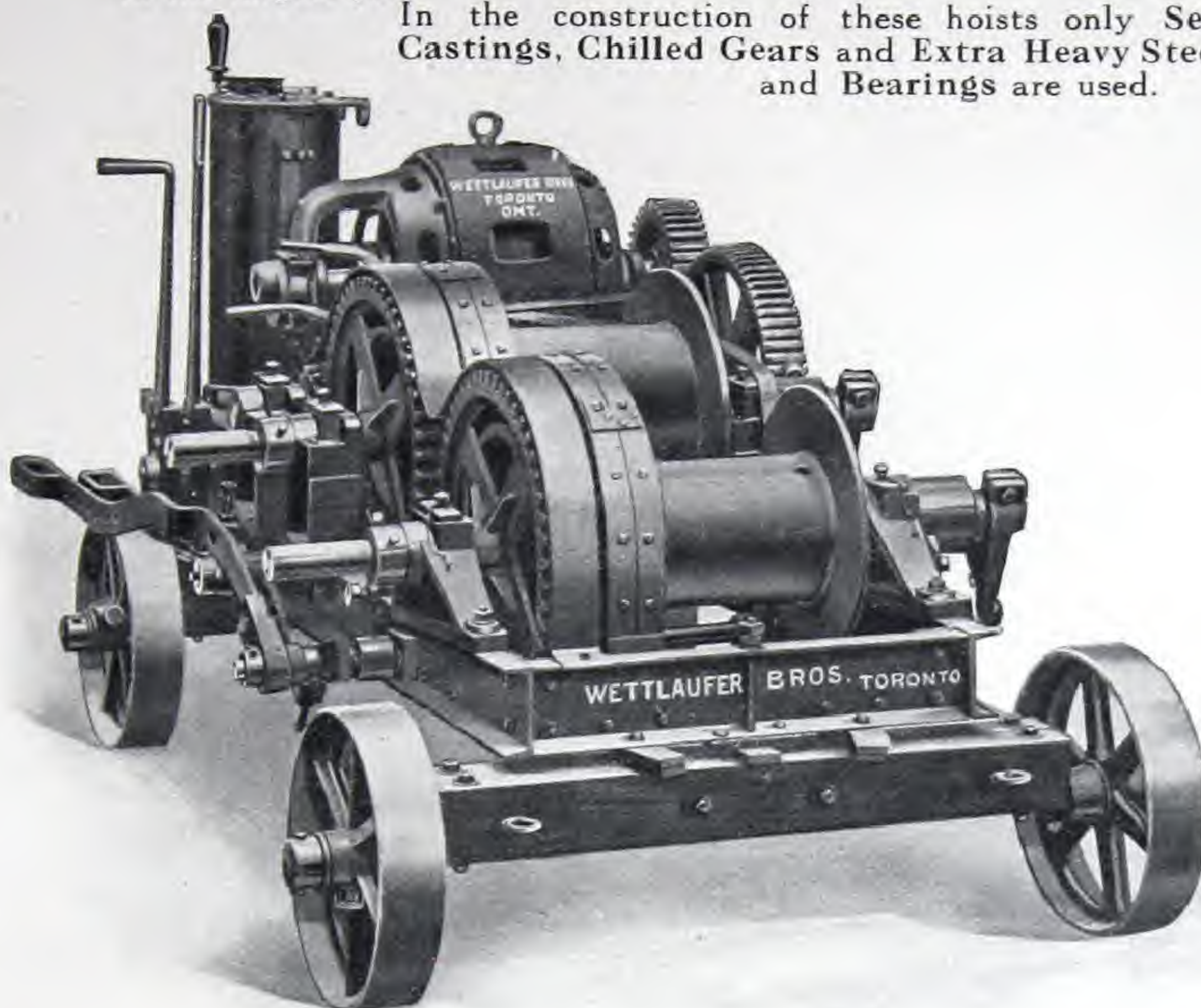
Our 1914 Model with its new improvements is in a class by itself.

Continued on next page

**Wettlaufer
Hoist**

Our Hoists have become popular with both large and small Contractors, because of their adaptability, simplicity of operation and durability. We make fourteen different types filling any condition from the smallest to the largest job.

In the construction of these hoists only Semi-Steel Castings, Chilled Gears and Extra Heavy Steel Shafts and Bearings are used.

**Crushers**

The Mitchell Improved Crusher is a Machine, Simple in Construction, good capacity, wearing qualities insuring long life, minimum cost in operating and a lower total cost of maintenance than any crusher on the market. The "Mitchell" Crusher is the only crusher that will take rock or ore and reduce 3 inch and smaller pieces down to sand in one operation. They are the only machines you can adjust instantly getting any size material you want.

**Further
Information**

Further particulars, information or estimates in regard to anything in our line will be gladly furnished for the asking.

THE GOOLD SHAPLEY AND MUIR COMPANY, LIMITED

BRANTFORD, ONT.

WINNIPEG
MAN.

REGINA
SASK.

CALGARY
ALTA.

Product Brantford Concrete Mixers.

Special Will mix as much concrete with less help than some others, and
Features more than most of the well-known concrete mixers on the market
Will measure accurately each batch of sand or gravel, cement
or water.



Other We also manufacture and carry complete lines of Gasoline
Lines Engines, Hoists, Tanks, and Towers for Sprinkler Systems, etc.
All gears, castings and parts throughout all our machines are
made by the best mechanics procurable and we guarantee
them free from all defects.

For quotation on your requirements drop us a line and we will
gladly and promptly attend to same.

BUILDING STONE, STONE MASONRY, AND ARTIFICIAL STONE

PROPERTIES OF BUILDING STONES. CRUSHING STRENGTH.*

This is a property to which undue importance has probably been attached; indeed, in some cases it may be the only test that is made on a stone. It can be safely assumed, as one writer has said, that a stone which "is so weak as to be likely to crush in the walls of a building, or even in a window stool, cap or pillar, bears such visible marks of its unfitness as to deceive no one with more than an extremely rudimentary knowledge on the subject.† Few stones will, when tested, show a strength of under 6,000 pounds per square inch, and many, especially igneous ones, stand as high as 20,000 to 30,000 pounds per square inch.

To be sure, in some large buildings a single column or block may be called upon to carry a heavy load, but even then it probably does

not approach the limit of strength of the stone.

Merrill has shown that the stone at the base of the Washington monument supports a maximum pressure of 22,658 tons per square foot, or 314.6 pounds per square inch.

Allowing a factor of safety of twenty would only require the stone at the base of the monument to sustain 6,292 pounds per square inch. Even at the base of the tallest buildings the pressure is probably not more than 160 pounds per square inch.

The following table shows the results of all the stones tested with the U. S. testing machine at the Watertown Arsenal from 1883 to 1905. The quantities in the columns headed "Min." represent the strength of the weakest stone of each particular kind, and are the mean of three tests; and similarly for the quantities in the columns headed "Max."

COMPRESSIVE STRENGTH OF STONES.†

Cubes set in plaster of Paris.

Kind of Stone	No. of Quarries	No. of Tests	Ultimate Crushing Strength					
			Pounds per Square Inch			Tons per Square Foot		
			Min.	Max.	Mean.	Min.	Max.	Mean.
Granite	10	37	2,045	27,738	19,379	147	1,990	1,400
Limestone.....	15	35	3,634	24,121	9,438	261	1,740	680
Marble.....	10	21	6,872	17,780	12,709	495	1,280	910
Sandstone.....	19	84	4,353	15,163	9,323	313	1,090	670

FROST RESISTANCE.

With other things equal, one might expect a stone of high absorption to disintegrate more easily than one of low absorption. This, however, is not always the case, for there are variable factors which affect the result.

The most logical method consists in soaking the stone in water to fill the pores as thoroughly as possible, and then exposing it to a temperature below freezing. This should be repeated at least twenty times, and any loss in weight measured or any disintegration noted.

An artificial method of frost resistance of a building stone consists in soaking the stone in a solution of sulphate of soda, and then drying it out, the theory being that the growth of the sulphate of soda crystals in the pores of the rock exerts internal pressure. The treatment is repeated a number of times.

This is much more severe than the ordinary freezing test, and gives abnormal losses by disintegration.

FIRE RESISTANCE.

The best form of test to determine the fire resistance of a building stone consists of building up a section of masonry of the stone to be tested.

This may form the interior of a chamber which can be heated to redness, or be built up in an iron framework which forms one movable wall of a furnace.

In either case the stone after being heated to about 1,750 degrees F. is cooled down by a strong stream of cold water from a hose.

Many stones after heating to redness and slow cooling emit a dull sound when struck. Lime rock, if heated above 850 degrees C., calcine to quicklime, but at a lower temperature they are less affected by heating and slow cooling than any other rocks. Granites seem on the whole to have a lower resistance than sandstones. Considered as a class, however, building stones are of low fire resistance, especially if rapidly cooled. In comparative tests they are often found inferior to clay products of non-vitrified character.

*Building Stones and Clay Products, Ries.

†A Treatise on Masonry Construction, Baker.

LIFE OF STONE.*

Observations on the buildings in New York have shown that the average "life" of stone in that climate is approximately as follows:
Life in Years, i.e., the Length of Time Before Repairs are Necessary.

Coarse brown-stone	5 to 15
Fine laminated brown-stone	20 to 50
Compact brown-stone	100 to 200
Blue-stone (sandstone), untried...	Probably centuries
Nova Scotia sandstone, untried, perhaps	50 to 200
Ohio sandstone (best siliceous variety), perhaps from one to many centuries	
Coarse fossiliferous limestone	20 to 40
Fine colitic (French) limestone ..	30 to 40
Marble, coarse dolomitic	40
Marble, fine dolomitic	60 to 90
Marble, fine	50 to 100
Granite	75 to 200
Gneiss	50 years to many centuries

The life of a stone depends to a limited extent on the method of dressing. The polished surface sheds water more easily than a rough one. A hammer-dressed rock, like sandstone, may disintegrate more rapidly than a sawed one.

Finally, position when in use is a matter not to be overlooked. Many stones of stratified or schistose character can be dressed more easily and more smoothly along the bed. On this account they are set in the wall on edge. This permits the rock to scale off more easily than if set on bed, for the pressure of the overlying blocks in the wall will resist the upward pressure of the freezing water, and it will exert itself parallel with the stratification.

Of course, some stone are so strongly knit together and the schistosity or stratification so slightly developed that they can be safely set on edge.

FINISHES USED FOR CUT STONES.

1. **Rock Face.**—This is the natural broken surface of the stone. If it is very rough, a small amount of chiselling with a point is permissible. Frequently the margin is tooled.

2. **Pointed Face.**—The surface is rendered comparatively flat by means of the point. A tooled margin is often added, as in the rock face.

3. **Hammered Face.**—In this style of finish the surface is rendered plain by hammering with patent hammers of different kinds. Many degrees of fineness are produced, according to the hammer used. By using the bush hammer, so that the cuts lie approximately parallel, a lined or streaked appearance is given to the surface. This method is often applied to granite.

4. **Ribbed or Tooth Chiseled.**—This finish may be given by using a wide flat-toothed chisel, but it is more commonly produced by machinery. It is usually employed with soft stones only, and is a common finish, very popular at the present time in the case of Indiana limestone. Makers of artificial stone frequently use this style of finish.

5. **Sand Finished.**—This is a smooth but not polished surface, produced by rubbing with sand either on the rubbing bed or by hand. It is a common finish for exterior marble work.

6. **Iron Finished.**—The surface is similar to that of the sand finish. It is produced in the case of granite by using the scroll wheel and crushed steel instead of rubbing bed and sand employed for marble and soft stone.

7. **Sawed Face.**—The surface is left as it comes from the saw; not commonly used.

Besides these methods of finishing, there are others differing in minor details. The square drove is a ribbed effect produced by using a broad flat chisel with a smooth edge. The ribs are not uniform, and they lie across the direction of work and not parallel to it. It is suitable only for margins, etc., as the length of the rib is the width of the chisel. To cover a broad surface with good square drove work is expensive. The term is not common use among the stonecutters, the expression "tooled margin" being far more common than "square drove margin." Special effects are produced by using the toothed chisel in two directions at right angles to each other and by directing the point along parallel lines instead of indiscriminately, as in the ordinary point face.

STONE MASONRY SPECIFICATION CLAUSES

All masonry shall be built according to the plans and instructions furnished by the architect.

All masonry built by contract shall be subject to the supervision of an inspector whose duties it shall be to see that the requirements of these specifications are complied with, but his presence shall in no way or in any degree lessen the responsibility of the contractor or his obligations.

The stone supplied shall be (name stone and quarry), and all stone work included in the drawings, which are part of this specification,

shall be cut according to detail drawings. All granite, including (steps, columns, base course, etc.) polished, axed-face cuts to inch, roughly-dressed stone (describe how surface shall be dressed). The cut stone furnished shall be equal to the samples deposited with the architect. Each block shall be free from sand holes, coarse laminations, flaws and defects. All stone rejected by the architect shall at once be removed from the premises, and any stone found cracked or defective when in place shall be removed and replaced with perfect material.

*Building and Ornamental Stones in Canada, Prof. W. A. Parks.

Stone shall be well wetted before setting, and well bedded, with full, squeezed-out joints. Joints between blocks where the weight is great, such as under columns, shall be set with five-pound sheet lead, centre cut for squeezing, and set back two inches from face. No ends plucked deeper than one-fourth inch, all beds and joints worked full. No angle mitres will be allowed on any part of this contract. All windowsills shall be one stone, unless otherwise ordered by architect. Grooves for water bar, flashings, etc., cutting and holing for iron work, copper dowels and cramps, cement filling, and other details according to good stone-setting practice, shall be observed by contractor.

The stone shall be carefully cut and dressed, forming headers and stretchers, which must be laid in regular horizontal courses in good cement mortar, with beds level, the ends and sides vertical and broken at least inches.

All foundation or footing courses must be made of select large stones not less than inches in thickness and having a superficial area of at least square feet.

No course of stone shall be less than nor more than inches in thickness, and each course shall be continuous around and through the wall, the courses decreasing, when at all, regularly in thickness from the bottom to the top of the wall.

Face stones shall be composed of headers and stretchers, and each stone in any course shall be of the exact thickness of the one adjoining it. The outer surfaces are to be rock face, but the edges shall be brought to lines corresponding to the finished dimensions of the masonry, and there shall be no projections of over inches beyond these lines.

The beds and joints of face stone shall be dressed back at least inches from the face of the wall and must be brought to a joint of not more than one-half an inch when laid. The under bed must extend to the extreme back of the stone; no overhang whatever will be allowed.

Stretchers shall not be less in length than two and one-half ($2\frac{1}{2}$) times their height, and no stone shall have a less width than one and one-half ($1\frac{1}{2}$) times its thickness.

Headers at least inches long shall be put in frequently to bond the wall, and they shall be so arranged that the headers of any course shall fall between the headers of the course immediately below it. There shall be one header to every stretchers, and they shall, as far as practicable, hold the size back into the heart of the wall that they show in the face.

When the walls do not exceed inches in thickness headers must run entirely through the wall, and in piers, a number of them shall extend through, even though the walls are of a greater thickness than this.

When walls exceed inches in thickness, there shall be as many headers of the

same size in the back of the wall as in the face, and so arranged that a header in the rear of the wall shall be between two headers in the front.

The backing and interior of the walls shall be of large, well shaped stone of a thickness equal to that of the corresponding face stone. No voids over inches in width shall be left between these stone, and all such voids must be filled with small stones and spalls thoroughly bedded in cement mortar or grouted. When the masonry is completed, it must contain no voids, and must be, as nearly as practicable, impervious to water.

All stones shall be prepared by dressing and hammering before they are brought on the wall, and must be so shaped that their bearing beds will be parallel to their natural beds. No heavy hammering will be allowed on the wall after a course is set, and should any irregularities occur, they must be carefully pointed off.

Each stone must be laid on its broadest bed without the use of chips, pinnars or levelers, in a full bed of mortar, so that no stone shall bear upon another stone at any point without a mortar joint intervening.

Care must be taken not to injure the joints of stone already laid. Should a stone be moved or the joint be broken the stone must be taken out, the mortar thoroughly cleansed from both the stone and the masonry and the stone then reset.

The stones in each course shall be so arranged as to form a proper bond with the stones of the course immediately beneath it, and in no case shall this bond be less than inches.

Both the stone and the masonry must be kept free from all dirt that will interfere with the adhesion of the mortar or cement to the stone, and in warm weather the stone and the masonry must be wet with clean water just before laying.

When masonry is built in freezing weather, the masonry and stone must be thoroughly freed from ice or frost by heating, and where practicable, the stone must be heated just before being set.

All sills as shown on plans shall be inches by inches, wallhold at each end, weathered, grooved for metal water bar.

Parapets shall be coped with inch by coping, moulded to detail drawing, saddle backed, points to be jagged, apex stones of size shown, deeply throated with kneelers, springers and borders.

Front entrance steps, size on drawings, steps two inches back below risers, surface of steps and risers rubbed. Threshold project one-half inch above floor.

All material shall be protected before and after laying, from all damage to risers and surface, and shall be raked down, pointed in mortar to match stone, and finished to flat surface, and washed down.

ARTIFICIAL STONE

GENERAL.

The tender for artificial stone is for supply and delivery only of all cut stone work indicated on drawings No. to same to be delivered on the premises at within days after acceptance of contract.

SETTING.

The mason contractor shall set all the stone herein specified, supplying the necessary dowels, anchors, etc.

DAMAGED STONE.

The contractor must be responsible for all damage to stone in transit, and must secure a written acceptance of the material as in perfect order, from the mason contractor upon delivery, as no broken or damaged stone will be permitted to be set in the building.

QUALITY.

All of the cut stone indicated on the drawings, or otherwise specified, is to be of artificial stone of the best quality, even in color and free from defects. A sample showing the cutting and finish proposed to be furnished must be submitted with the tender, and the work must be performed in every respect to the samples submitted, and approved. All beds and builds are to be cut full and square, all arrises sharp, and all side joints vertical, extending so to the back of all stones. All projecting courses are to rest on the wall, a distance at least equal to one inch more than their projection. All projecting stones are to be cut with a deep drip. All stones coming in contact with roof, or where flashing is required, shall have proper reglets cut in them. And the contractor is to do any other cutting of the stone required. At the changes of direction in coping stones, etc., the joining must be arranged so water running down

the inclined surfaces will not seep into the joints. All stones over 30 inches long, columns, balusters, window heads and sills to be reinforced to the architect's approval. All necessary reinforcing is to be included in the tender, and no extra charge made on this account.

FINISH.

Specify the finish to be applied on all exposed surfaces, whether cast surface or worked after the piece is made.

BEDS AND REVEALS, ETC.

The water table shall be bevelled (45 degrees) with inches projection and inches bed on the upper side. Window jambs splayed inches on face and inches reveals. Mullions splayed, formed in one piece, dressed on back to fit window box, and rebated and anchored to steel columns provided by another contractor; mullions to have inches reveals. Heads splayed, to be inches on face with inches reveals, inches longer than openings at each end, and cut out to receive lintels as shown. All copings shall be for inches walls and shall project sufficiently to form ample drip on both sides of the flat portions weathered on top. Sills and heads running through wide brick mullions to be jointed vertically over each pier, as shown on the elevations.

All window sills to continue inches under wood sub-sills and to be cut on top for metal weather bar.

ORNAMENT.

Execute all ornamentation indicated on the elevations from detail drawings furnished for same. The contractor shall have full-sized models made, and inspected by the architects, before executing the work in stone.

Stones for Building and Decorations, Geo. P. Merrill. Jno. Wiley & Sons, New York.

Masonry Construction, I. O. Baker. Jno. Wiley & Sons, New York.

Building Stones and Clay Products, H. Reiss. Jno. Wiley & Sons, New York.

Building Construction and Superintendence, F. E. Kidder. The Wm. T. Comstock Company, New York.

Building Construction, C. F. Mitchell. The D. Van Nostrand Company, New York.

Building Stones of Canada, W. A. Parks.

Report of Department of Mines, Ottawa.

ARGENTEUIL GRANITE COMPANY, LIMITED

Offices :
42 Craig St. W., Montreal

Quarries, Cutting Plant & Crusher,
Brownburg, Que.

Product Building Granite, Crushed Granite, Paving Sets.

Capacity We turn out 1000 tons of crushed granite per day.

Facilities We have one of the largest Quarry Crushers in Canada. Our plant is equipped with the most modern machinery for quarrying and manufacturing anything in our line.



A Corner of our Quarry.

Recent Contracts We have recently supplied the stone for the following buildings:
Postal Station H, Montreal, Cox & Amos, Architects.
Montreal High School, E. & W. S. Maxwell, Architects.
Dandurand Building, St. Denis & St. Catherine Sts., Montreal, Ross & McDonald, Architects.
and many others which space forbids us to mention.

Estimates Estimates and samples are furnished free.

THE CANADIAN ART STONE CO., LTD.

353 PAPE AVE., TORONTO

MONTREAL

OTTAWA



Product

"Art Stone" registered.

"Art Stone" is a composition stone in which is united every feature an ideal building stone should possess. In color, texture, strength, and general appearance, it equals the best natural stone. The facing consists of non-staining cement, chipped marble and silica. The backing is the best concrete that can be manufactured.

Adaptability

"Art Stone" can be moulded to any Architectural detail, and whether used in plain blocks or the most intricate ornamental finish its appearance is impressively beautiful. It can be used in any place where a building stone is required.

Cost

Although we employ only the most skilled artists and workmen in our modelling department and factory that are obtainable, we are able to furnish the finest grade of ornamental work at a very much lower price than that of natural stone. The cost being in some cases 50 per cent. less.

Shipping Facilities

Our large factory and shipping facilities enable us to handle any size of contract. We can make complete and rapid deliveries on time limit contracts in any part of the Dominion.

Estimates and Co-operation

We will be pleased at any time to co-operate with architects, contractors or designers in the preparation of details.

Estimates of cost from plans, or any other information or data connected with our product, will be gladly furnished free of cost.

Correspondence is invited from interested parties.

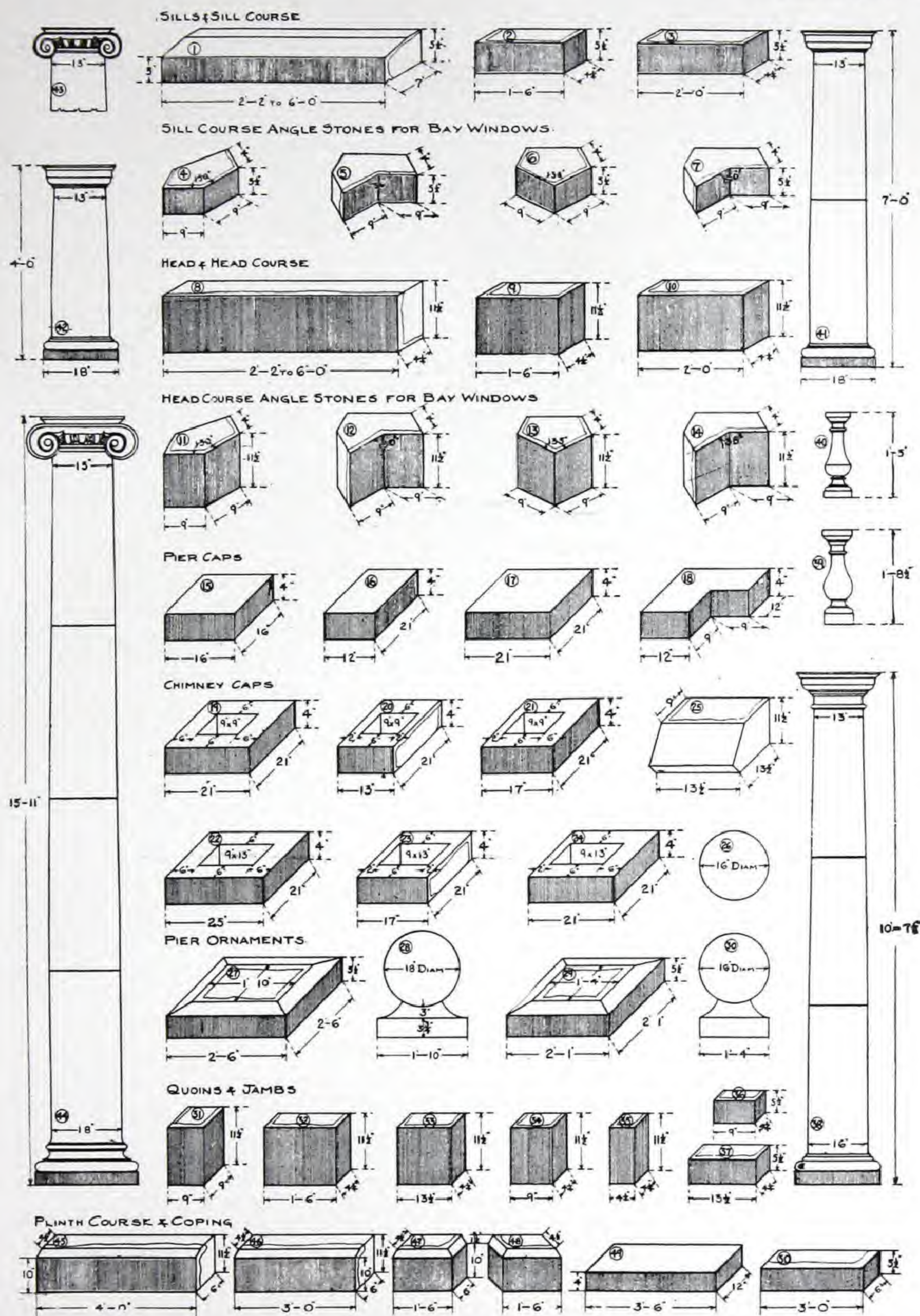
COPYRIGHT, CANADA, 1913

BY

The CANADIAN ART STONE CO. Limited

353 PAPE AVENUE, TORONTO

Write or Telephone for Discounts



No.		No.		No.		No.		No.						
1	Sills, per foot	.50	11	Lintels course, each	1.10	21	Chimney Caps ea.	2.00	31	Quoins each	1.10	41	Column complete	48.00
2	Sill course, each	.50	12	" " "	1.30	22	" " "	3.00	32	" " "	1.00	42	" " "	30.00
3	" " "	.70	13	" " "	1.10	23	" " "	2.50	33	" " "	.80	43	Column Cap ea.	20.00
4	" " "	.50	14	" " "	1.30	24	" " "	3.00	34	" " "	.50	44	Column com.	150.00
5	" " "	.60	15	Pier Caps	1.50	25	" Weathering	3.00	35	" " "	.40	45	Plinth each	4.00
6	" " "	.50	16	" " "	1.50	26	Ball each	4.00	36	" " "	.40	46	" " "	3.00
7	" " "	.60	17	" " "	2.50	27	Pier Cap	8.00	37	" " "	.40	47	" " "	1.50
8	Lintels, per foot	.70	18	" " "	2.00	28	" Ball	12.00	38	Column complete	75.00	48	" " "	1.50
9	Lintel course, each	1.00	19	Chimney Caps	2.50	29	" Cap	6.00	39	Baluster each	5.00	49	Coping	2.50
10	" " "	1.35	20	" " "	2.00	30	" Ball	10.00	40	" " "	5.00	50	Coursing	1.50

CORINTHIAN STONE COMPANY



Product Corinthian Stone is Solid Stone, has No Facing to crack or peel off. Is Cast in sand moulds from the best materials to ensure strength and density. Can be Cut and finished same as Natural Stone, has tested over Two Tons per sq. inch crushing strength.

Corinthian Stone Corinthian Stone is used for all kinds of Cut Stone Work, Carved Capitals, Columns, Mouldings, Plinth, Coursing, Sills, Heads, etc.

Made in Canada Made in Canada by Canadians, from Canadian Material.

Prices Prices are low in comparison with Natural Stone, and estimates will be furnished promptly on receipt of plans, drawings or quantities.

Co-operation We are ready, at any time, to prepare details or supply drawings or catalogues for Architects and Builders.
Before placing your stone contracts be sure you get our prices.

See Our Works Architects and Builders are cordially invited to visit our Office and Works, and acquaint themselves with the superior qualities of Corinthian Stone.

Agents for Quebec:—HYDE & SONS, 12 Bleury Street, Montreal

THE MONARCH STONE COMPANY

226 DANFORTH AVE., - - TORONTO, ONT.

ANYTHING IN ARTIFICIAL STONE

Our Make We manufacture a guaranteed stone of great strength, heavily reinforced with iron.

“Monarch” stone in strength, color and texture equals the best natural stone.

Quick Service We can give you exceptionally quick delivery on special orders.

Our Methods “Monarch Stone,” good stone, reasonable price, and furthermore, you will get the stone “When you want it.”

**Estimates, Inform-
ation,
Etc.** We will be pleased to co-operate with Architects, Contractors, or Designers, in the preparation of details.
A call over the phone or a postal will receive our prompt attention.
Estimates, or any other information on our product, we will gladly furnish on request.
Correspondence solicited from interested parties.

Some Stock Prices	Fluted Verandah Columns.....	each	\$5.00
	Cap and Base (Cap 18 in. x 18 in. Base 16 in. dia.)....	“	3.00
	Sills.....	per lin. foot	.25
	Heads.....	“ “	.30
	Plain Caping.....	“ “	.35
	Pier Caps, 16 x 16 inches.....	each	1.00
	Pier Caps, 20 x 20 inches.....	“	1.15
	Pier Caps, 24 x 24 inches.....	“	1.50

We also make rock faced sills and caps to order.

WILLIAM PENN STONE CO.

Plymouth Building

MINNEAPOLIS - MINN.

WILLIAM PENN,
President.

J. P. EATON
Secretary, Treasurer.

Products Stone and Granite of all descriptions.

Quality We guarantee our goods sound and reliable.

Estimates We furnish estimates on all kinds of stone and granite.

Shipments We guarantee prompt shipment of orders to any part of Canada.

References Furnished cut stone for Canadian Pacific Railway Depot, Vancouver, British Columbia, also many Bank Buildings, Churches, School Houses, and Business Blocks throughout Western Canada.

THE ROMAN STONE CO., LIMITED

Head Office:

For Quebec:
T. A. MORRISON & CO.
204 St. James St., Montreal

1060 YONGE ST.,
TORONTO

Pattern Shop, Foundry and
Stone Yard
WESTON, ONT.

Products

Roman Stone to architects' details. The name "Roman Stone" is a registered trade mark. The process has been brought to great perfection and is protected by the Stevens patent.

The stone is cast in sand moulds, and is composed of crushed marble and selected cement, in the proportion of $3\frac{1}{2}$ to 1.



This is the Thirty-fourth Branch Bank we have finished for the Canadian Bank of Commerce.

It is dressed and tooled after it has matured.

It stands a test of over one ton pressure to the square inch.

Advantages

Over Natural Dressed Stone. "Roman Stone" can be reinforced to carry any load.

It can be easily set, as hooks are cast in the top of each stone.

Ashlar can be firmly bonded by wall ties cast in the backs of the stones. It has no seams, stains, flint or other imperfections.

We make no second grade of stone.

Over Other Artificial Stone, which is made by the "dry process," i.e., by being rammed into wooden moulds.

"Roman Stone" can be cut or carved, as it is of the same quality throughout, this is a great advantage.

"Roman Stone" is perfectly crystalized, on account of abundance of water in the mixture, which runs into the sand moulds keeping the stone saturated for days.

"Roman Stone" has greater density and toughness, owing to the method of casting in sand.

Machine Tooling is possible after the stone is matured. This gives a better finish than tooling secured by wooden forms.

Cost

The price of "Roman Stone" is always lower than that of cut natural stone, sometimes being as much as 50% less. The greatest saving is possible when the design calls for repetition of complicated or ornamental details.

No work too elaborate for us.

Tenders given promptly for all Cut Stone work, delivered or set.

SEND US YOUR PLANS.

W. J. HALL

SANITARY ENGINEER

89 Barton Ave.
Toronto

SHOW ROOM

1097 Yonge Street,
Toronto

HALL'S SANITARY DRINKING FOUNTAINS

Product Sanitary Fountains, Cast Iron, Marble and Cement Pedestals.

**Applica-
tion** Hall's Sanitary Fountains are applicable to any style of fixture that is in use for Parks, Public Buildings, and Play Grounds.

**Used By
City of
Toronto** Hall's Sanitary Fountains, as illustrated, installed complete with waste and water pipes in an "Art Stone" Pedestal is being used by the City of Toronto in the parks, Playgrounds, Exhibition grounds, street corners, schools and colleges, for its superiority in design, construction, durability and sanitation.

**Descrip-
tion** The Fountain is manufactured of extra heavy cast brass and highly nickle plate.

Prices Sanitary Fountain—self-closing valve, porcelain push button, and pressure regulating valve. \$8.50, F.O.B. Toronto.

Sanitary Fountain, installed complete, with art stone pedestal. \$35.00, F.O.B. Toronto.

We furnish free directions for installation.

**Informa-
tion** For further information as to discounts, etc., write us and we will attend to your needs promptly.



One-tenth of full size



Patent applied for

TORONTO ORNAMENTAL STONE CO.

OFFICE AND WORKS:

232 ST. CLARENS AVE., TORONTO

SUPERIOR STONE TRIM

- | | |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product | A Manufactured Stone, unsurpassed in color, beauty of surface texture, weathering qualities and density. |
| Improved Process | Under improved processes used in manufacture, repetition in plain and tooled surfaces has been eliminated; angles, corners and arises come clean, smooth, accurate. |
| Comparison | Color, texture and general appearance surpasses limestone or sandstone. We particularly emphasize reinforcement, density, and naturalness of appearance of stone of our manufacture. |
| Qualities | Correct grading of aggregates, under thorough test, experimentation and weathering has resulted in splendid and most pleasing stone, with a density approximating natural stone and possessing superior weathering qualities. |
| Examples of Work | <p>Some especially fine stone-tracery to windows—Northern Congregational Church, Rosedale Toronto, (Gothic Design), and other ornamental stone to entrances, etc., has been executed by us. A few of our recent contracts are:—</p> <p>Keiths Limited, Toronto, Sproatt & Rolph, Architects.
 North Toronto High School—Page and Warrington, Architects.
 Canadian National Sanitarium, Weston (two buildings)—
 Dennison & Stephenson, Architects.
 Northern Congregational Church, Rosedale, Toronto—John E. Gemmell, Architect.
 C. W. Dunning, Residence Lawrence Park—Chadwick & Beckett, Architects.
 Madison Theatre, Toronto—J. A. MacKenzie, Architect.
 Maclean Publishing Co., University Ave., Toronto—John M. Lyle, Architect.
 Standard Mortgage Corporation, New Hamburg—Chadwick & Beckett, Architects.
 Canadian Military Insititute, Toronto—Chadwick & Beckett, Architects.
 Chapman & Walker, Bldg., Richmond St. W.—Chadwick & Beckett, Architects.
 Landscape decoration, including stone Arbor, Bridges, etc., estate of Mr. Harry Ryrie, Rosedale, Toronto—C. J. Gibson, Architect.</p> |

SPECIFICATION CLAUSES FOR MARBLE WORK, CLAY TILE AND TILE FLOORING

STAIRS.

Stair treads shall be of marble inches thick, with moulded nosing. Risers of marble inches thick. All to be bedded and jointed in approved fashion and properly anchored. Specify stringers, balustrades, etc.

WALLS.

Walls shall be lined with marble, inches as indicated on drawings. Tiles to break with joints with each other unless otherwise specified. Wall pieces to be well backed with plaster at anchors, so that wall is solid and firm.

Skirtings, mouldings, cornices, etc., to be of marble moulded as shown in details.

CARVING.

All carved work shall be modelled in suitable material and submitted to the architect for approval before the marble is cut. All lettering must also be submitted.

LAYING FLOORS.

The contractor must see that all foundations, or sub-floors, are perfectly level and free from spring or vibration. Defects must be reported and rectified before work is proceeded with. The contractor is to prepare and lay a concrete foundation of Portland cement, water washed sharp sand and gravel or broken stone. Cinders will not be allowed. Concrete foundation must be allowed to harden before setting the tile. The foundation, when hard, to be brushed or washed thoroughly clean, well soaked with water and given a thin coat of pure, dry Portland cement before applying cement mortar for tiles. Lime mortar shall not be used. Concrete to be a 1-2-4 mix, and cement mortar a 1-2 mix.

Foundation should not be less than 3 inches thick, well tamped, and level in all directions for any length.

Tiles are to be well tamped into the cement mortar and given at least two days for cement to set. After this the floor is to be washed clean with water and broom and joints well grouted with pure Portland cement. As soon as grout begins to set the floor is to be rubbed perfectly clean.

Three days at least must be allowed before floor is walked upon and seven days before any weight is placed upon floor or any pounding allowed.

CLEANING UP.

The contractor is required to remove all surplus material, debris, scaffolding, tools, etc., from the premises, and leave his work and the building clean and free from all evidence of his operations.

SPECIFICATIONS FOR MARBLE WORK. KINDS OF MARBLE AND STOPPING.

All marble furnished shall be the best of its kind. Specify the kinds of marble and the parts of the work where same are to be used. Stopping, where necessary, to be neatly done, and material used colored to be not unduly noticeable.

SAMPLES.

Samples of new marble, or marble to be substituted for that specified, shall be furnished free to the architect for his approval, and such samples shall be large enough to show extreme color variations.

FASTENINGS.

Hold-fasts or anchors shall be of heavy copper wire, and of sufficient number to make a firm and permanent job. Visible supports of copper or brass to be used where indicated; such bolts, screws, rosettes, etc., to be to details or the architect's approval.

WORKMANSHIP.

All cutting and polishing must be done in a workmanlike manner, and the polish on all pieces must be equal. Surfaces to be continuous at all joints, and plumb or level, as the case may be.

The contractor will be required to drill all necessary holes and make all cuttings in his work to suit plumbing, steam fitting and other trades, and to leave his work in a finished condition after these trades.

FLOORS.

marble shall be used in floors and all pieces must be of equal hardness and finish. The following thickness of marble tiling is satisfactory:

	7/8 in. thick.	1 1/4 in. thick.
Dimensions of tile, up to and including	18x18 in.	36x36 in.
Dimensions of bolders up to	18 in. wide	24 in. wide

SPECIFICATIONS FOR CLAY TILE

CLAY TILE.

Clay tile for floors or interior decoration may be obtained in almost any color pattern or finish desired. The most common kinds on the market are known as:—

Vitreous Floor Tile.—Supplied in standard sizes up to 6 inch x 6 inch x $\frac{1}{2}$ inch, non-absorbent.

Semi-Vitreous Floor Tile.—Nearly non-absorbent, standard sizes.

Inlaid Floor Tile.—Laid in pattern, both semi and vitreous.

Ceramic Mosaic.—Semi-vitreous and vitreous, for floors interior or exterior.

Art Mosaic.—Hand-cut mosaic, either vitreous or semi-vitreous, for floors, fire places, etc.

Enamel or Glazed Tiles.—In bright, matt or dull finish, embossed or decorated, hand decorated, and in almost any size or color; are used for every kind of interior trim, ornament or surface.

Specify the kinds of tiles required, colors, sizes, shapes, and so on, free from cracks, chips, crazing, warp or blisters, generally equal to sample submitted to architect.

FOUNDATION FOR WALLS.

A good foundation is absolutely necessary, and should be solid and perfectly plumb, free from any spring or vibration, before applying scratch coat, to prevent tile coming loose.

SCRATCH COAT.

The Scratch Coat should consist of one part best quality Portland cement, two parts clean, washed, sharp sand. Mix the cement and sand thoroughly dry and sufficient water to form a thick mortar.

The Scratch Coat should be allowed to harden for at least one day before commencing to set tile, thoroughly brushed to remove all dust, and well wet, brushing on thin coats of pure liquid Portland cement before putting on cement mortar for setting tile.

TILES PLACED ON STUDDING.

When tiles are placed on studding, the studding should be placed fifteen-inch centers, thoroughly braced to prevent vibration, and covered with expanded metal lath.

Scratch coat on metal lath should be $\frac{1}{2}$ inch thick, or sufficient to make an even and true surface to within $\frac{1}{8}$ inch of intended finished surface of tile when tile $\frac{3}{8}$ inch thick are used. Scratch coat should be roughly scratched.

TILE PLACED ON BRICK WALLS.

When tiles are placed on brick walls, mortar must be raked out of joints of brick work before using to form key for scratch coat.

NEVER PLACE ON WOOD OR PLASTER.

Tile must never be placed on wood lath or on plaster. If placed on plaster blocks, they should be driven full of nails, or wire lath placed over them. Plaster block material

does not form a good bond with cement and in a short time tile tend to come loose and drop off.

CEMENT MORTAR.

Cement mortar should consist of one part best quality Portland cement, two parts clean, washed, sharp sand, thoroughly mixed as directed for floors.

If any lime is mixed with cement mortar, to prevent it setting too quickly, it should never equal 10 per cent., and great care must be used to have lime well slacked and made free from all lumps by passing through a fine sieve to guard against "heaving" or "swelling," and thus "loosening" or "lifting" tiles. White rock finish can be used as above in place of lime. Before setting tile and after carefully placing last coat of cement mortar to receive tile, place over it with a plasterer's trowel a very light coat of pure cement mixed to a consistency of thick cream.

GROUTING.

Joints should be grouted with Keene's white cement or with pure light gray Portland cement, if more character is desired to tile work.

SOAKING TILE.

All tiles should be thoroughly soaked in clean water before placing on the wall. Dirty water or water off of cement will stain tile, causing variation in shade and making an unsatisfactory job.

METHOD OF SETTING TILE FOR WALL OR WAINSCOTING.

Tiles are first laid out and compared with plan provided for setting them. Guide strips are then placed on wall, parallel, and about two feet apart, bottom one being arranged to allow base to be set after body is in place.

When a cove base is used, it may be necessary to set it first, but in all cases must be well supported on the concrete. The strips must be placed plumb and even with intended finished wall line.

The method of setting wall tile is governed to some extent by conditions of wall on which they are to be set, and mechanic must decide at time which process he will use, whether buttering or floating, as equally good work can be done by either by following instructions as stated below.

FLOATING WALL TILE.

Mortar is spread between guide strips about five feet at a time, and levelled with screed notched at each end to allow for thickness of tile. Tiles are placed in position and tamped until firmly united to cement and level with strips. When space between strips is completed on one side of room, strips are removed and work continued in same manner until completed. When tiles are all set, joints must be carefully washed out and neatly filled with thinly mixed pure light gray Portland cement or Keene's cement. All cement remaining on tile must be carefully wiped off.

BUTTERING WALL TILE.

Cement mortar is spread on back of each tile, and tile placed on wall and tamped gently until firmly united and plumb with guide strips. When tiles are all set, joints must be carefully washed out and filled with cement, and tiles cleaned as directed above.

FIXTURES.

When fixtures of any kind are to be placed on tile work, such as plumbing in bathroom, provision should be made for them by fastening wood strips on wall before rough or first coating of cement mortar is put on, strips to be same thickness as rough coating. Tiles can be placed over strips by covering them with

cement mortar, and, when thoroughly set, holes can be bored in tiles for fastening fixtures without injuring tiling.

NO WALKING OR POUNDING.

Caution should be used not to allow any one to walk upon or carry anything heavy over floor, or have any pounding about wall work for several days, or until tiles are firmly set. Unless these precautions are taken, it will be impossible to guarantee a first-class job. Tile work is frequently condemned when the fault lies with the rush of other contractors to finish their work.

Do not allow tile to get wet and lay in sawdust, as it will stain the tile.

TILE FLOORING**FOUNDATION FOR FLOORS***

A good foundation is always necessary, and should be solid and perfectly level, free from spring or vibration. Tile must always be laid upon a concrete foundation, prepared from the best quality Portland cement and clean, sharp, washed sand and gravel.

Cinders should never be used, as they tend to destroy the life of cement, but if used, all ashes must be screened out and the vitrified cinder or clinker thoroughly washed. (The sulphur in cinders will destroy reinforcing in concrete.)

Concrete should be allowed to thoroughly harden before laying floor; thoroughly brushed to remove all dust; well soaked with water, dusting on concrete thin coat pure Portland cement before applying cement mortar for laying tile.

Concrete should never be allowed to stand more than three or four days before laying the tile.

LIME MORTAR.

Lime mortar should never be mixed with concrete.

CONCRETE.

Concrete should consist of one part Portland cement, two parts clean, washed, sharp sand, four parts clean gravel.

Mix cement and sand thoroughly dry, add gravel and mix, adding sufficient water to form, when laid, a hard, solid mass when well beaten to a bed. Bed should be not less than three inches thick. Surface of concrete must be level and finished to within one inch of finished floor line (when tile $\frac{1}{2}$ inch thick is used), which will leave space of $\frac{1}{2}$ inch for cement mortar.

CEMENT MORTAR.

Cement mortar should consist of one part best quality Portland cement, two parts clean, washed, sharp sand, thoroughly mixed as directed for concrete. All mortar should be used fresh, before it has its initial setting.

*From Spec. of the Associated Tile Mfrs.

REINFORCING.

Place on top of the concrete an open metal lath and spread the cement mortar over it. This will prevent the tendency to contraction of the cement mortar and separation of the tile into floor cracks.

Before laying tile sprinkle carefully with fine hand screen a little dry cement over floor on top of cement mortar.

GROUTING.

Joints to be grouted with pure Portland cement, mixed with clear water, cleaned soon as grouting is done, leaving no cement scum on surface.

FLOORS IN NEW BUILDINGS.

When tiles are laid on joists in new buildings, if possible, joists should be set five inches below intended finished floor line, spaced twelve inches on centers, thoroughly bridged, to make stiff floor, covered with one-inch rough boards not over six inches wide (three inches preferred), thoroughly nailed, and joints one-eighth inch apart to allow for swelling.

A layer of roofing paper on top of rough floor will protect boards from moisture of concrete, and prevent moisture from dripping through to ceiling below.

FLOORS IN OLD BUILDINGS.

Cleats are nailed to joists five inches below intended finished floor line, and short pieces of boards (not over six inches wide), one-eighth inch apart, fitted in between joists upon cleats and well nailed. Joists must be thoroughly bridged. Place roof paper as above directed. Corners on the upper edge of joists should be chamfered off to sharp point, as flat surface of joists will give uneven foundation. When strength of joists will permit, cut an inch or more off top. Where joists are too weak, strengthen by thoroughly nailing cleats six inches wide full length of joists.

When solid sub-foundations is thus prepared, concrete is placed upon it as above directed.

IRON BEAMS.

Where iron beams and hollow tile arches are used, frequently very little space is left for preparing proper foundation for setting tile. The rough coat is usually put in by hollow tile contractor to protect his work. This cover should always conform to requirements for a solid tile foundation. Should this not be the case, the tile contractor must remove sufficient of covering to allow him to put down a foundation that will insure a satisfactory tile floor. Cinders, lime, mortar or inferior material must never be used.

The tops of iron beams should be three inches below the finished floor line to prevent floors showing lines on the beams.

METHOD OF LAYING FLOOR TILE.

Semi-vitreous or vitreous tiles for floors are first laid out to ascertain if they are all right, and compared with plan provided for laying floors. Strips are then set, beginning at one end of and in center of room, and level with intended finished floor line. Two sets of guide

strips running parallel about 18 to 30 inches apart should be set first. Mortar is then spread between them for six to ten feet at a time, and levelled with screed notched at each end to allow for thickness of tiles. Tiles are placed upon mortar, which must be stiff enough not to work up between the joints. Tiles are firmly pressed into mortar and tamped down with block and hammer until exactly level with strips. When space between strips is completed, strips on one side of tile are moved out 18 to 30 inches and placed in proper position for laying another section of tile, using tiles which have been laid for one end of room, and laying of tile continued in same manner until floor is finished.

When cement is sufficiently set, which should be in about two days, floor should be well scrubbed with clean water and broom, and joints thoroughly grouted with pure cement, mixed with water to consistency of cream. As soon as this begins to stiffen, it must be carefully rubbed off with sawdust or fine shavings and floor left perfectly clean.

Marble and Marble Working, W. G. Renniecke. D. Van Nostrand Co., New York.

THE LAUTZ-DUNHAM COMPANY, LIMITED**MONTREAL****TORONTO****BRIDGEBURG****Marble** Foreign and Domestic.

Architectural and Structural.

For all Interior Work.

Tile For Floors, Walls and Ceilings—Glazed, Encaustic, Vitreous, Ceramics, Faience, Quarry, Terrazzo, and Mosaics.**About Our Marble** We do not specialize in one particular color or kind, but have the largest assortment of Marble in Canada.

In our line we have Marble, representative of every Marble producing country in the World.

About Our Factory Our mill at Bridgeburg has the most modern equipment in Canada and can supply Marble for the largest and smallest contracts.

We employ none but the most skilled artisans and turn out nothing but a finished and superior product.

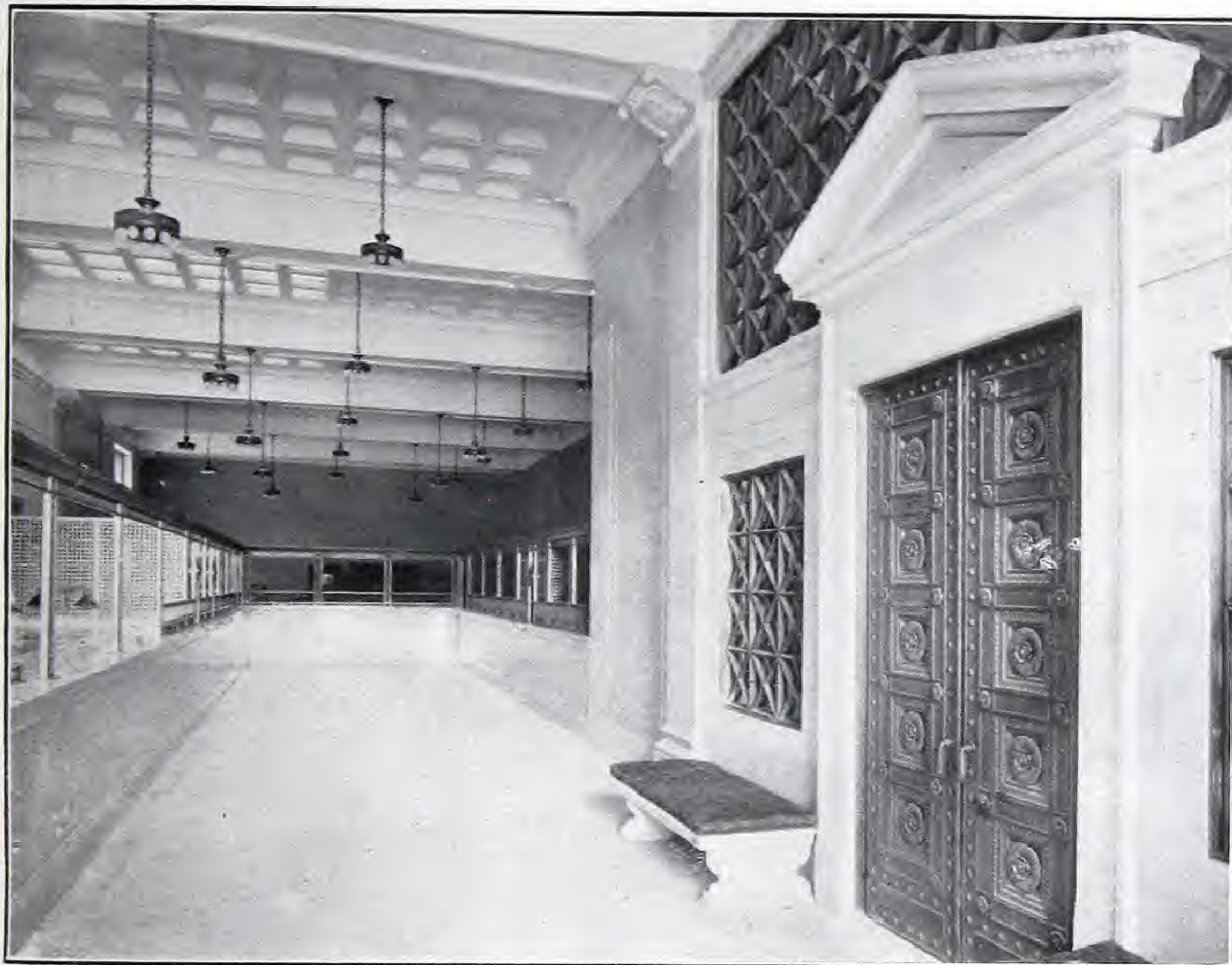
Service We gladly co-operate with architects in the working out of details, color-schemes and effects.**Experience** Our experience has extended over a period of more than thirty years and our various connections in all the producing markets in the world places us in a position to serve our trade advantageously.

Correspondence promptly attended to

THE SMITH MARBLE AND CONSTRUCTION CO., LIMITED

MONTREAL, CANADA

Product Manufacturers of and Contractors for—
MARBLE TILE SLATE TERRAZZO



Banking Room, Royal Bank, Winnipeg
Showing Marble Walls, Floors and Door Head.

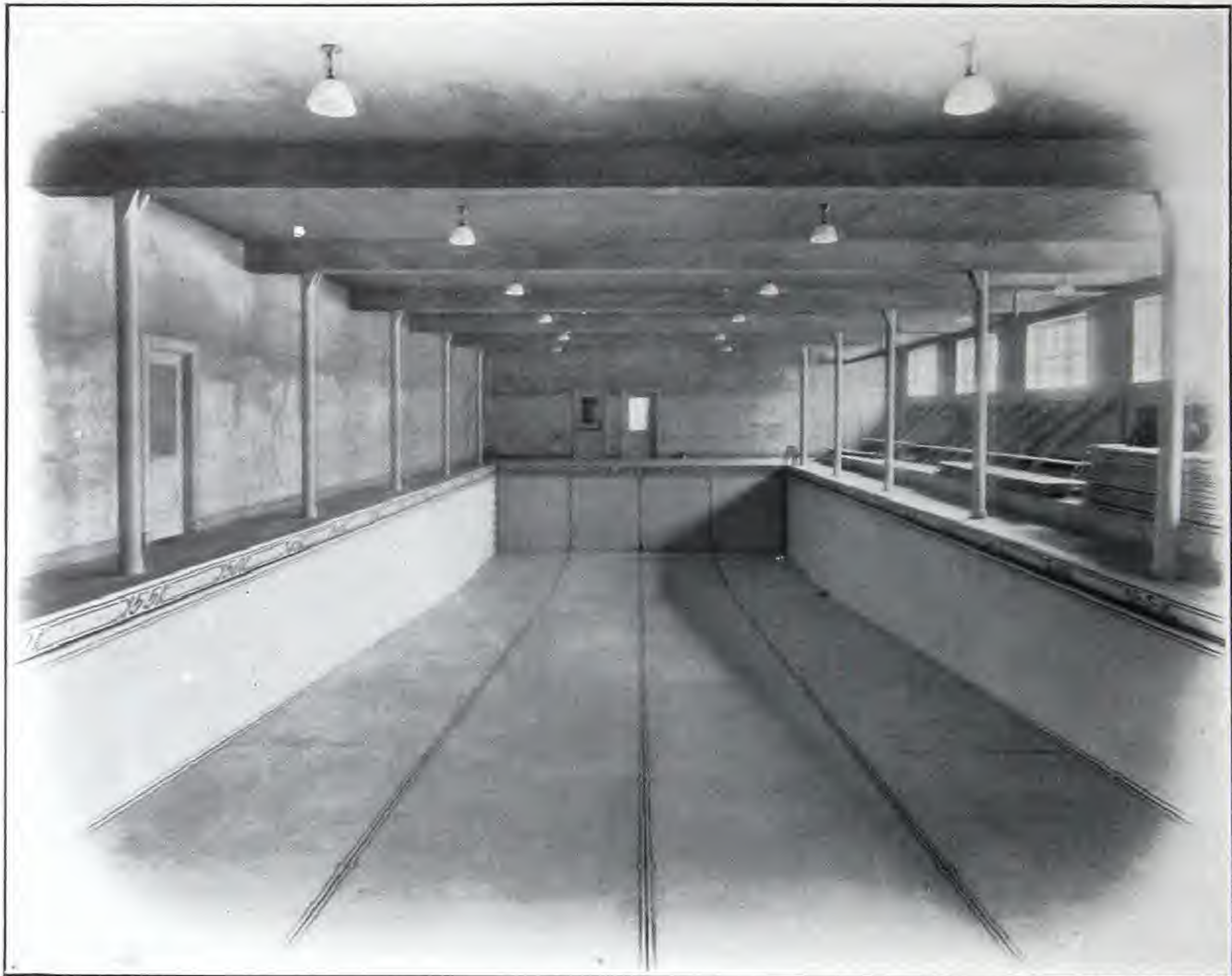
Reference Contracts for Marble recently completed by us—
Chateau Laurier, Ottawa—Ross & McDonald, Architects.
Mappin & Webb Store, Montreal—McVicar & Herriot,
Architects.
McGill St. Building, Montreal—R. E. Bustrom, Architect.
Postal Station C, Montreal—Jos. Perrault, Architect.

**Informa-
tion and
Estimates** Information and Estimates furnished on request.

THE MOSAIC TILE COMPANY OF ZANESVILLE, OHIO

New York Office, 30 West 24th Street

Products Floor Tile, including Ceramic Mosaic, Vitreous and Encaustic; Wall Tile, including all styles of Cap and Base Mouldings, with angles and stops; Enameled Tile for Fireplace Work, Art Mosaic (Ceramic) for Floors and Walls, including Fireplace Work; Porcelain Brick for the lining of Ball Mills.



Swimming Pools Ceramic Tile for Swimming Pools is the most popular and durable material that has ever been used for such purposes.

It will never wear out, permits a wide latitude of design and is the most economical material that can be used.

We make a specialty of Swimming Pools and are always ready to furnish designs and estimates.

Floor Tile Ceramic Mosaic This class of floor tile is made in six different sizes, namely; $\frac{3}{4}$ in. and $\frac{1}{2}$ in. squares, 13-16 in. rounds, 1 in. and $1\frac{1}{4}$ in. hexagons, 11-16 x $\frac{1}{2}$ in. herringbone.

Our cut or Art Mosaic is supplied in either $\frac{1}{2}$ in. or $\frac{5}{8}$ in. tessera.

Continued on next page

THE MOSAIC TILE COMPANY OF ZANESVILLE, OHIO

Vitreous & Encaustic Enameled Tile Both of these grades of tile flooring are made in the usual sizes and colors. Enameled Tile, for fireplace and walls, are manufactured in all colors and shades in both matt or dull and bright glaze.



Plate 713A

Glazed Wall Tile

Our White Glazed Wall tile excels any other material in the market, and is always uniform in size and color, so that the effect is pleasing to the eye. It is very desirable for bathrooms, kitchens, stores, and all spaces where a sanitary wainscoting is wanted. (See plate 713A).

Granite Floor Tiles for Outside Use

Considerable trouble has been experienced in securing a tiling which is suitable for outside porch and terrace floors, and other spaces exposed to the elements. Until we introduced our red and grey granite tiling no satisfactory material for this purpose had been produced. This granite tiling is made from a combination of clays which can be burned at the greatest heat in a kiln. The result is a tiling which can not be disintegrated by the weather, and hence will retain its appearance when used for outside work. It is also very attractive in color and can be made into very pleasing designs by combinations with some of our other standard colors.

We make this material in all Ceramic sizes, also in 6 x 6 in., 6 x 3 in., 6 x 2 in. and 6 x 1½ in. strips, and in 2 in. hexagons, 3 in. hexagons and 3 in. octagons, and are therefor prepared to substitute it for any other material specified.

Facilities

We carry at all times sufficient stock both in New York and at the factory to fill orders promptly.

A large and well-equipped Design Department is always at the disposal of customers or architects.

Special water color designs will be supplied upon receipt of floor plans or measurements.

WRITE FOR CATALOGUES AND SAMPLES,

ARCHITECTURAL TERRA COTTA

1. WHERE USED.

The architectural terra cotta embodies all material indicated on drawings, such as

2. COLOR AND QUALITY.

The terra cotta is to be of a color which will match the limestone specified matt white glaze, matt cream glaze, full white glaze, full cream glaze, polychrome, as marked on drawings, as per sample selected by the architect.

The material to be made of the very best clay burned to a uniform color and hard enough to give a clear ring when sounded with iron. The pieces to be straight and true with moulds of uniform size where continuous; no warped or discolored terra cotta will be accepted.

The terra cotta shall be free from kiln cracks and faults, and have sufficient webbs on the inside to give the material the required strength.

3. TOOLING.

The surfaces are to be tooled, about six to the inch, run vertically in even lines, and the whole is to be of impervious finish.

4. DETAILS.

The architect will furnish three-quarter scale—or full size—details showing the layout of the terra cotta work. The manufacturer will immediately, on receipt of same, proceed to get out shop drawings showing the construction of the terra cotta work, and will at once forward same to the architect for his approval before starting actual work.

The shop drawings submitted by the manufacturer will show the construction of the material where same comes in contact with iron work and other materials, indicating where same should be supported by iron anchors, straps, or other iron work. The shop drawings submitted by the manufacturer shall be for normal terra cotta construction.

5. MODELING.

All ornamental work to be modelled by the very best and skilled artists in strict accordance with the architect's design, and photos of same submitted to the architect for his approval before the work is burned. Corrections, if any, are to be made at the expense of the manufacturer.

6. PROJECTION AND BOND.

All projections to be in strict accordance with architect's details. All plain ashlar to be deep enough to secure perfect bond, and all material coming in contact with frame or iron work shall have at least 2-inch bond back of same.

7. JOINTING AND FITTING.

All joints to be true and straight and fit the abutting work exactly. The work for the first two storeys and all work above which, if

not found true and straight, must be put on a rubbing bed and rubbed to a perfect joint. The manufacturer will furnish setting plan showing the sections and numbers of the terra cotta pieces as they go into the building. The work must be laid out and fitted before shipping, and each piece marked with section and number. The manufacturer is not required to do any fitting at the building unless by error made on his setting plans.

8. SETTING.

The general contractor is to set the terra cotta as per setting plans furnished by the terra cotta contractor, and in accordance with the architect's plans and details. The sections and numbers given on setting plans must be followed when setting the material.

The general contractor must provide iron anchors or supports wherever required as per plans furnished him by the manufacturer and architect. The terra cotta must be properly filled in at the back with broken brick bats and cement.

9. MORTAR.

All exposed joints must be, after the work has been set, pointed up with some approved mortar, consisting of lime putty colored with "Peerless," "Picora," or other stains, to match the terra cotta work.

10. CARE AT BUILDING.

The general contractor will take proper care of terra cotta shipped and delivered at building, and keep same in a dry place under roof or covered up with boards. General contractor is liable for any breakage or damage done to the material after same has been delivered to the building. All projecting terra cotta must be protected with planks during the erection of the building.

11. CLEANING.

The general contractor must, after the completion of the work, carefully clean down all terra cotta work.

GENERAL.

The contractor will be required to furnish all the material, including all necessary standard and special shapes for the proper fitting to the steel work, also all bonds, anchors, fastenings, etc., of every description required to erect the same in place complete. Furnish all the tools, machinery, hoisting apparatus and centering necessary to carry on the work.

The contractor is referred to the plans and details for the general construction, and especially the steel diagrams and details showing connection between the structural steel and tile work. He is to begin work as soon as notified that the building is ready for his work and to carry his work to a successful conclusion within _____ days from the date of such notification.

The carpenter will furnish and erect rough wood frames at all openings in partitions and furring.

DETAILS.

When requested to do so the contractor shall furnish for the architect's approval large or full-scale detail drawings for all special shapes, column coverings, lintel covers, and general type of arch, etc.

TILE.

All the terra cotta tile required for this work shall be of hard burned clay, semi-porous (or porous). To be well manufactured; no badly split, cracked or warped tile will be permitted to go into the work. Material to be that manufactured by

LAYING.

All the tile work shall be laid in mortar composed of one part Portland cement, of approved brand, three parts sharp sand, and not more than 10 per cent. of hydrated lime, all thoroughly well mixed together as follows: the sand and cement are to be mixed together dry, and sufficient water added to thoroughly wet same. All tile must be laid with full flush joints, plumb to a line, with horizontal beds uniformly level on each course. Fill all the joints and crevices between the tile and steel work with mortar well slushed in.

ARCHES.

The arches for the floors, in general, shall be inch flat (or segment) arches (side) (end) construction. Skewbacks must be carefully bedded in place against beams.

BEAM TILE.

The soffits of all beams to be protected with slabs of tile at least one inch in thickness.

ROOFS.

The arches for the main roof are to be inch flat (or segment) arches same as specified for the floors. The roofs of pent houses, roof over projecting portions, floor of bulkheads, and other portions indicated on details as book tile shall be made of three-inch (3-inch) book tile set in place between steel T sections. Steel to be furnished by the steel contractor.

PARTITIONS.

All partitions must start on steel beams or on fireproof floor arches. Partitions shown on the plan to be built the thickness indicated in figures. If no dimensions are given, the following sizes will govern: Partitions for all corridors and for partitions over feet and up to feet in height to be (4) inches. Partitions over feet in height to be inches, and all cross partitions feet or less to be (2) inches. Partition walls to be built straight, true, plumb and well bonded, with proper break joint bond on each alternate course, and all joints thoroughly flushed up with mortar, and to be well wedged underneath fireproof ceiling.

FURRING.

Where indicated on plans, 2-inch furring tiles are to be built against the outside walls

of the building. These tiles are to be secured to the brick walls with metal bonds at every (second) course, built into the brick work at intervals not greater than (36) inches apart.

The curb wall in basement shall be furred with (3-inch) tile extending up to the under side of the iron plate along edge of curb wall and properly fitting around all beams.

COVERING.

Column covering shall start in all cases directly from the tile floor arches, and shall be designed to properly fit the columns. All corners of square columns shall be left (square) (round). Column covering to be wired once (twice) in each course in height or secured together with clasps. Pieces must be set to break joints. Furnish and set where required for nailing, metal nailing-plugs of approved type. All girders, beams, channels, etc., that show below the under side of ceiling are to be incased on all sides with at least two-inch thickness of fireproof tile secured to the steel in the usual manner. If required, special designs must be submitted to the architect. All soil, vent, down-spout and water supply pipes shall be boxed in, using (3-inch) tile, starting from the floors in all cases. This boxing shall not be done until the pipes have been properly tested, and covered by another contractor. There shall be no openings into boxes except for outlets on the various floors. Where these outlets occur small wood frames furnished by carpenter shall be set by the fireproofing contractor.

PENT HOUSES, ETC.

The contractor shall build the walls of pent houses with (4-inch) hard or glazed tile, laid up in Portland cement mortar, all joints to be thoroughly flushed.

Curbs of all skylights shall be built of (4-inch) tile.

FLOORS.

All toilet-room floors, where shown on plans, shall be raised approximately inches with fireproofing. Supports to be so arranged as to not interfere with the piping of these rooms.

After the floor arches have been set in place, and at such times as may be designated by the architect, the contractor for carpenter work will furnish and set the 2-inch by 3-inch wood floor strips required for nailing ground for the finished wood flooring, where wooden flooring is called for.

After the strips have been set, the fireproofing contractor must fill in between the same with concrete filling: this concrete is to be composed of one (1) part Portland cement, of approved brand, and ten (10) parts broken tile, stone, gravel, or fine, clean coal cinders, thoroughly mixed together dry, and then tempered and mixed, and tamped in place. In no case shall cinder concrete be allowed to come in contact with structural steel.

CLEAN UP.

Remove promptly from the premises all the tools, scaffolding, unused tile, debris, etc., as soon as the work is completed.

HOLLOW TILE FIREPROOFING

GENERAL.

Provide and erect all the hollow tile exterior walls, for interior bearing partitions, subdividing partitions, etc., as shown on the plans. All material must be hard-burned, true and regular in size, and shall have all faces scored with special dove-tail scoring to offer a good surface for the stucco finish. Blocks badly cracked or broken on the outside shells will not be acceptable under this specification. In general the terra cotta blocks must be those manufactured by

LAYING.

All blocks used in the exterior walls and interior bearing partitions must be laid with the holes or cores vertically in the wall in order to develop their full strength. Interior sub-dividing partitions may be laid on the side if desired. Tiles to break joints with each other unless otherwise directed.

FOUNDATION WALLS.

Where so indicated on plans, the foundation walls from top of footings to the underside of the first floor beams should be constructed of (12 x 12 x 12) hollow tile. Care should be taken at the corners to use (6 x 12 x 12) blocks to secure a running bond in the wall.

WALLS, PARTITIONS, ETC.

Exterior walls, and partitions, will be of thickness shown on the plans, and must be in accordance with the foregoing conditions of quality, etc.

Sub-dividing partitions will be of hard-burned terra cotta tile. All partitions must be started on the structural floor and wedged against the floor arch above.

Provide for all hung windows, special jamb blocks with rabbeted opening to receive the window frame box. Fill well with mortar the space between the blocks and the frame box to prevent the passage of air or moisture through same. Furnish and set where required for nailing, metal plugs of approved type.

Construct the lintels over all openings with special lintel blocks, with arch blocks or with wall or jamb blocks, reinforced with steel bars and concrete, as per details. Care must be taken not to bulge the lintels outward when placing the concrete.

Form all sills of 4-inch hollow tile laid on the side, with a slight tilt so as to shed water. Care must be taken to fill all joints so as to prevent moisture working through the same.

Build all arched openings shown as brick on the plans, of two-course rowlock, common or hollow brick header arches, carefully laid on substantial centers. Arches will spring from the terra cotta block, and must be well bedded on same. Arches of approximately 3 feet inner radius may be constructed of lays as used for flat arch lintels.

PORCH COLUMNS AND PIERS.

Construct the porch columns and piers, sizes as shown, of hollow terra cotta blocks. Where column finish is round, build same of 3-inch round hollow terra cotta column covering, filling the same with concrete where the second-storey walls are supported by them. When columns are filled with concrete, they should be wired before pouring. Square columns will be built of the proper size wall tile.

FLOOR BEAM BEARINGS.

Provide and set terra cotta slabs 1 inch thick under all floor beams as bearing plates for same. These slabs will also be used for working up to levels and storey heights when the full or half blocks do not work out correctly.

ROOF PLATES.

Embedded at intervals of five feet in the wall under the roof plate, $\frac{3}{4}$ inch bolts 30 inches long, with nut and washers and projecting 6 inches above the top of wall, to allow of the plate being fastened down. Fill around bolts with cement grout before placing roof plate.

Fireproofing of Steel Buildings, J. K. Freitag. Jno. Wiley & Sons, New York.

K. M. Mathiasen, Pres. E. V. Eskesen, Sec'y & Treas. L. B. Eskesen, Vice. Pres.

THE NEW JERSEY TERRA COTTA COMPANY

Established 1888

MANUFACTURERS OF ARCHITECTURAL TERRA COTTA

Singer Building, 149 Broadway, - New York

Agents:

WEBSTER & SONS, LTD.,

31 Wellington St., Montreal, Can.

WARRINGTON & JOHNSON,

303 Duncan Bldg., Vancouver, B.C.

Products Architectural Terra Cotta for interior and exterior building decoration.**Color** The New Jersey Terra Cotta Company's product is burned to a very high degree of heat producing a vitreous non-absorbent surface. The standard colors are furnished in grey, buff and cream; also in imitations of limestone, granite, etc. Glazed, matt glazed and polychrome terra cotta are furnished in all fancy colors and shades.**Location** Perth Amboy, N.J., where the factory is located is known as the centre of the terra cotta manufacturing industry. Clays best adapted for the manufacturing of architectural terra cotta are mined in the neighborhood.

New U.S. Post Office Building, 8th Ave., between 31st and 33rd Sts., New York City.

McKim, Mead & White, Architects.

Geo. A. Fuller Co., Contractor.

Facilities The New Jersey Terra Cotta Company's plant is up-to-date in every particular, new modern fire-proof buildings having lately been erected. The most modern methods known to the industry are employed. The Company maintains a large staff of skilled designers and modellers and in this respect is second to none in the industry.**Shipments** The New Jersey Terra Cotta Company has a reputation to uphold in this department. A progress system originated by the Company makes delay in the manufacture of the material practically impossible and excellent railroad facilities enables it to make prompt delivery to any part of Canada.**Service** Architects and Builders are invited to make use of the Company's large staff of draughtsmen and estimators. Co-operation is always sought to obtain the best results.

References	U. S. Post Office, New York City. Fayette National Bank, Lexington, Ky. Munsey Building, Washington, D.C. Munsey Building, Baltimore, Md.	}	McKim, Mead & White, Architects. Geo. A. Fuller Co., Contractor.
-------------------	----------------------------------------------------------------------------------------------------------------------------------------------------	---	---------------------------------------------------------------------

Montefiero Home, New York City,	{	Buchman & Fox and A. W. Brunner, Architects. Hedden Construction Co., Contractor.
---------------------------------	---	-----------------------------------------------------------------------------------------

GEORGE E. SIEBERT

208 DONALDA BLOCK,

WINNIPEG, MAN.



Tribune Building, Winnipeg
J. D. Atchison & Co., Architects

Co-operation and Estimates

Our design department is prepared to co-operate with Architects and others in the study and preparation of decorative schemes and effects.

Requests for suggestions or estimates will receive our most prompt attention.

We solicit enquiries regarding our product and are glad to confer as to the practical matters of detail. Send to Geo. E. Siebert or to Head Office direct.

Reference

Hudson Bay Building,
Vancouver, B.C.

Hudson Bay Building,
Calgary, Alta.

Hudson Bay Building,
Victoria, B.C.

Oldfield Building, Winnipeg.

Olympia Building, Winnipeg.

Architectural Terra Cotta

For above buildings supplied by
**The American Terra Cotta and
Ceramic Co.**, Office, Peoples Gas
Building, Chicago; Factory,
Terra Cotta, Ill.



Union Trust Building, Winnipeg.
J. D. Atchison & Co., Architects

CARPENTRY AND JOINERY

GENERAL.

The contractor must provide all material, labor and tools necessary to make this building complete, as shown by the drawings, mentioned in these specifications, or as will be directed by the architect. The work must be commenced immediately upon the acceptance of the contractor's offer, and must be carried on promptly, and satisfactorily completed within _____ days from date of acceptance. The care of the building will rest with carpenter, who will provide all necessary temporary doors and fastenings, and will provide keys for other trades to give access to the building at all proper hours, and will see that the building is properly closed at night and on Sundays. If temporary heating is required, this contractor is to arrange for same; making use of such heating apparatus as may be installed, or supplying "salamanders," if such are not installed. He is to provide and construct all necessary and suitable scaffolding for all trades, except mason, required in the construction. The carpenter must enclose all openings with cheese cloth, or make other temporary arrangements to enclose all windows and doorways if so required, and as will be directed. He must also provide all temporary closets for the workmen of all trades.

MATERIAL AND FRAMING.

All the woodwork used throughout the building, or in connection therewith, in any part of the work herein described, shall be (except where otherwise specified) of the best quality and description of _____ free from sap, shakes, dead, loose or large knots, wave or other defects, etc., and must be prepared, framed and constructed according to the drawings and sections. All floor joists properly sized to widths and jointed (crowning on top edge), and all materials thoroughly seasoned. The carpenter must prepare a pole for storey heights between timbers for mason to lay his walls by. Also provide all centering and turning pieces, as may be required for the mason.

JOISTS AND RAFTERS.

All joists and rafters to be _____ Sizes, etc., may be seen on the drawings; all to be sized and left true and square. Joists to be double when stud partitions run lengthwise of the joists. The roofs and ceilings, including porches, entrances, etc., to be supported with ceiling joists and rafters, all as will be further detailed. The joists throughout to be laid level for floors and ceilings, and to have not less than 4-inch bearing on the walls, the ends of all joists to be cut out on the bevel. Joists to be thoroughly bedded on walls and held in position by strips until they are built in.

BRIDGING.

Cross bridging to be made of sound stuff, 2 by _____ inches, well fitted, put in as

soon as joists are leveled, and spiked with two _____ inch wire nails each end. Joists from 9 to 12 feet bearing, on row; 12 to 18 feet, two rows; 18 to 25 feet, three rows.

HEADERS AND TRIMMERS.

To be double thick, well framed and spiked together, leaving all openings of sufficient size for finish of stairs, chimneys, skylights and scuttles, and, in no case, within two inches of the brick of any smoke flue. Trimmers and headers for stairways and hoistways must be treble thick in all storeys, hung in iron stirrups, size $\frac{1}{2}$ by $2\frac{1}{2}$ inches, made so as to let in flush with top of timber. All openings in brick or stone work to have (wooden) lintels behind the stone caps, or arches, not less than _____ inches thick, by the required width, to cover the thickness of wall.

ANCHORS.

Provide and fix iron anchors _____ inch by _____ inch by 4 feet long, one end turned up _____ inches and built into wall where directed, the other end built down over floor and ceiling joists and on parallel wall to go over 3 joists and fastened with two _____ screws. Cross anchors to be at not more than 8 feet centres, and to be tied through walls. Provide and fix wrought iron anchors to the ends of every fourth joist, to be _____ inches by _____ inch by _____ feet in length, turned up _____ inches at one end and built into the brickwork, and the other end fastened and bolted to joists and _____ screws.

PARTITIONS.

Construct stud partitions where shown on the plans with _____ studs at 16 inches centres; with plates at top and bottom, and two rows of diagonal bracing of the same size; studs to be doubled at openings and at angles. Construct temporary partitions under the centre of all rooms and halls to support joists until roof is on, joists bridged and floors laid.

FURRING.

All outside brick or stone walls, also all walls shown with _____ on plans must be furred off with strips 1 x 2 inches, placed 16 inches centres, nailed on walls vertically, and plumb for lathing; also fur with 2 x 4, where walls are of unequal thickness in same storey. Also fur where necessary all partitions, where soil, waste or vent pipes are placed. Cross-fur ceilings with strips 1 x 2 inches, placed 16 inches from centres, where joists are used. Fur off all walls where inside shutters are indicated on plans, or specified, to be of sufficient distance to admit of them with 2 x 4 inch studding, placed 16 inches between centres, thoroughly secured to the wall.

GROUND.

Put up grounds for the finish of all windows, doors, bases, casings, chair rails, etc., before plastering. Those on wooden partitions to be inches; those on brick or stone wall $\frac{7}{8}$ x 2 inches. Provide all wood grounds on steel beams as directed; also make such wood grounds as may be required by the roofer. In the top of the brick walls form all necessary grounds, etc., for fastening the metal coping.

STAIRS.

The front stairs from the first to the third storeys are to be supported on (2 by 12 inch) well-season white pine (spruce, Douglas fir, long-leaf pine) "carriages," carefully shaped to fit the treads and risers, and set level and true in line. There are to be four carriages and a 3 by 4-inch wall-bearer for stairs from the first to the second storey, and three carriages from the second to the third storey. The wall-bearers are to be securely spiked to the walls. Landings are to be formed of (2 by 8-inch) joists. The rough work of the stairs is to be firmly put up, and is to be self supporting without the aid of angle-newels.

No finished work is to be put up until the plaster is dry.

Newels.—The main newel-post is to be (6 by 6 inches in size), built up, fluted (paneled) on all four sides, and is to have a molded and turned cap with one (carved) member, neck-molding and hand-carved rosettes. It is also to have a $\frac{7}{8}$ inch molded base.

All other newels are to be (5 inches) square, fluted newels, with molded and turned caps, neck-moldings and rosettes in the neckings. A turned ornament is to be put on the bottom of each drop-newel.

The rail is to be double-molded out of ($3\frac{3}{4}$ by $3\frac{3}{8}$ inch) stock, with ramps and easings at all newels. Sections of rail are to be bolted together and to newels.

Balusters.—Balusters $1\frac{1}{8}$ inches square are to be turned to (three) patterns and are to be set ($3\frac{1}{2}$ inches) on centers.

Molded panels about (12 inches) wide to center of rails are to be used for panelling under the rake of the first flight and on all soffits. Stiles and rails are to be $1\frac{1}{8}$ inches thick and plain panels are to be used.

Open-String Stairs.—The front stairs from the second to the third storey are to have open strings, molded nosings with $\frac{7}{8}$ -inch coves underneath, returned at the ends and carried around the stair-well, $1\frac{1}{8}$ inch treads and $\frac{7}{8}$ -inch risers, the treads ploughed into the risers, and the risers into the under side of the treads, and the base dadoed into both; (1 inch) turned balusters (three) to a tread and around the stair-well, in same proportion, all dovetailed at the foot and tenoned into the under side of the rails; ($3\frac{1}{2}$ by $3\frac{1}{2}$ inch) double molded hand-rails, with no ramps, 4 by 4 inch solid, turned newels at the angles with caps and neck-molds and half-newels at the upper terminals of the rails. The newel at the foot of the stairs is to be 5 by 5 inches, boxed, carved, and fluted, and finished with a molded cap and base.

The base on the wall side of the stairs is to be rebated and is to have a $2\frac{1}{2}$ by $\frac{7}{8}$ inch molding to match the base around the hall. All stock is to be clear, kiln-dried (whitewood, cypress, white pine, or any of the hardwoods, etc.), put up in the best and strongest manner. The stairs are to be furred on the under side for plastering.

WINDOWS.

All windows for this building must be of the forms, styles and dimensions as marked on plans, elevations, sections and details, or as hereinafter described. All pulley styles to be thick, or with best noiseless axle pulleys. Sash hung to sash cord and cast iron weights, secured with sash lock and two lifts. Sash to be of . Braces are to be fitted in across all window frames, to keep them perfectly straight while being built in.

Windows in the following rooms

are to have 5 by $\frac{3}{8}$ inch molded casings with $1\frac{3}{8}$ inch molded back-bands mitered at the angles. Back-bands are to have $\frac{3}{8}$ inch turned and quartered bead-moldings.

All windows in are to have $5\frac{1}{2}$ inch pilaster-casings, with turned corner-blocks 1 inch thick, and plain $1\frac{1}{8}$ inch plinths (10 inches) high. Windows in laundry, kitchen, pantries and rear hall are to have 5 inch O. G. casings.

Windows are to have $\frac{7}{8}$ inch sub-jambs with box casings veneered with $\frac{3}{8}$ inch strips in all rooms finished in hardwood; and $1\frac{1}{8}$ inch molded stools and 4 inch molded aprons. Stop-beads, $\frac{1}{2}$ inch thick, and of the same kind of wood as the finish of rooms, are to come flush with the box casings, and in first storey are to be returned on top of the sill.

DOORS.

All doors (except stock doors) are to be paneled and molded in strict accordance with the scale and detail drawings furnished for the same. All panels are to be loose and neither glued nor nailed. All tenons are to have $\frac{3}{4}$ inch haunches.

Veneered doors are to have staved-up, thoroughly kiln-dried white-pine cores, with solid moldings and $\frac{1}{4}$ inch veneering of kiln-dried wood, well glued on both sides.

Sliding doors are to have an astragal-joint (male and female) in the center and $\frac{5}{8}$ by $1\frac{1}{4}$ inch friction-molds on all edges.

Front Doors.—The front doors are to be (2 inches) thick, veneered on both sides with clear, quartered (white oak) and panelled as shown, with raised panels and moldings with a ($\frac{1}{4}$ inch) turned bead set in the moldings.

Vestibule doors are to be made to correspond with outside doors, except that the upper panel of each door is to be glazed with polished plate glass with a (2-inch) bevel. Front and vestibule doors are to have astragals worked from 2 by 3 inch oak, glued to the meeting-stiles of the swinging leaves.

Kitchen, Basement and Other Doors.—The kitchen and basement outside doors are to be made of clear, well-seasoned, white pine

(Georgia pine), $1\frac{3}{4}$ inches thick, with (four) plain panels and flush moldings, (or are to be four panels (O.G.) stock doors, first-quality, and $1\frac{3}{4}$ inches thick).

All doors opening into are to be $1\frac{3}{4}$ inches thick, with five raised panels and flush moldings. All are to be veneered with the same kind of wood as the finish of the rooms.

Doors opening from any of these rooms into closets, are to be veneered on both sides with the same kind of wood.

All other doors are to be ($1\frac{1}{2}$) inches thick, made of solid pine (white-wood) and paneled with five panels with flush moldings.

Sash Doors.—The door from is to have the upper part divided into (six) lights by wooden muntins, and is to be glazed with chipped (ribbed) glass; the glass and labor for glazing are to be furnished by the carpenter.

All other doors.—All other doors throughout the building are to be four-panel (O.G.) stock doors ($1\frac{3}{8}$ inches) thick (with plain panels and flush moldings on both sides).

Door Frames.—All inside doors are to have $1\frac{3}{4}$ inch rebated and beaded frames of solid pine or whitewood for the pine and whitewood doors, and are to be veneered with $\frac{1}{2}$ inch veneer in rooms finished in hardwood. Where a door is between rooms finished in different woods, the frame is to show the corresponding wood on each side (or all inside doors are to have ($1\frac{1}{8}$ inch) frames with $1\frac{3}{4}$ inch O.G. stops, glued and beaded to the frames. Frames are to be blocked solid for the hinges.

Where a door opens between rooms finished with the same kind of wood, the frame is to be solid; but where the adjoining rooms are finished with the different woods, the frame is to be veneered with $\frac{1}{2}$ inch veneers of the corresponding woods on $\frac{7}{8}$ inch pine cores.

All frames are to be set square and plumb.

Thresholds.—All inside doors are to have $\frac{5}{8}$ inch molded thresholds of quartered oak for veneered doors and of Georgia pine elsewhere.

FLOORING.

Provide and lay inch by inch square edged No. 1 (hemlock) at an angle of 45 degrees, with the joists, on the top of all joists. The boarding on the top of the ceiling joists and all roof joists and rafters to be laid square or cross-wise (6) inches wide and of matched (hemlock). (For specification for finishing floor see chapters on flooring.) Floors to be finished in the best quarter-cut, kiln and air dried oak flooring, inch thick, matched and ploughed on the under side. Strips to be inches wide and not less than feet in length.

GENERAL WORK, ETC.

Furnish all the carpenter's work required for water closets, wash bowls, baths and sinks, hot air furnaces, heating pipes, gas fitting, plumbing, bell hanging, speaking tubes and cast iron work to make the whole complete, and in a good, sub-

stantial and workmanlike manner. Build all balconies, courts, bay windows, storm doors and windows, wire screens, steps and outside cellarways, etc., as per drawings. All closets finished with shelves to each, and beaded strips extending around the closets inches wide, with clothes hooks every eight inches. Furnish and set case of cupboards with sash doors, and three drawers under broad shelf of kitchen drawers, sideboards in dining-room, linen closet, wardrobe, vegetable cellar, storeroom, medicine case, etc., as shown on plans and details or as mentioned below, all of seasoned, kiln-dried materials. Do all boxing for water pipes in cellar with (double) boxing to keep from freezing; also box with beaded stuff where soil or waste pipes are exposed. Make good all damages to wood work. Give the plumbers, gas fitters, heating contractor, etc., notice when building is ready to have the same put in. Raise floors under plumbing fixtures where necessary. All proper bond, timbers, cradles for arches, etc., and wooden brick of every description necessary for the proper execution of the work to be furnished by carpenter; also all lumber necessary for lookouts, decks and furring for the tinner, galvanized iron work, etc., all straight and true; also build all necessary scaffolding to do the carpenter work properly.

FINISH.

All door and window casings, bases, etc., in the several stories, to be the styles, form and dimensions as per detailed drawings or as described. All casings, bases, etc., to lap one inch over the grounds, and fit perfectly to the plastering, and no finish put up before plastering is dry. Furnish and put up hardwood corner beads, where required, with acorn tops, or otherwise, as shown. Put up base knobs where necessary. The whole to be done in the most substantial and workmanlike manner, with thoroughly seasoned and kiln-dried lumber. Put $\frac{1}{4}$ -inch round carpet strips throughout the finished floors.

HARDWARE.

All locks, bolts, butts, knobs, latches, trimmings and fastenings and shelf hardware of every description must be properly fixed to all doors, sashes, blinds, shutters, etc., in a workmanlike manner, and to be furnished as follows: or selected, or approved by the architect. This contractor must also include in his tender the furnishing of all nails, screws, bolts, etc., that may be required.

FINALLY.

The contractor must clear out all lumber, shavings, etc., and all other loose rubbish from all rooms in the several storeys, sweep all floors clean, and remove all rubbish from the premises on completion of his contract. All damage to adjoining property, caused by this contractor, to be repaired and left clean and whole on completion.

INTERIOR FITTINGS

GENERAL CONDITIONS.

All the stock for interior finish of every kind is to be of the very best quality, free from knots, or sap, thoroughly seasoned and kiln dried (and of selected grain). All is to be smoothed, scraped and sandpapered by hand before it is put up, and on completion, the work that is to have a natural finish, is to be properly cleaned and freed from all stains and finger-marks.

No interior finish of any kind is to be taken to the building until the plaster is thoroughly dry, and all hardwood finish and flooring are to be taken direct from the drying kiln to the building.

All moulded work is to be stuck in accordance with the full-size sections.

THEATRES.

The seating accommodation is the most important item.

The seats should be on strong cast-iron frames, picked out in bright colors, and should be made self-folding, to allow of the least obstruction in passing in or out between the rows.

The usual height of seat from floor line is 1 ft 5 in., width 1 ft. 6 in., and depth when occupied 1 ft. 3 in. The width between the rows from back to back should never be less than 2 ft. 1 in., and for the better parts of the house 2 ft. 3 in. to 2 ft. 5 in.

An appliance for securing a hat should be provided under each seat.

Assembly halls are usually provided with movable chairs or seats, and benches and forms are very commonly used.

The box office should be provided with a pay door, with a projecting ledge about 4 ft. from floor. The size of the opening is usually about 18 in. square, and the top may be decorative, rounded, or curved.

BANKS.

Pay counters are built up from the floor in heavy massive panels with solid tops, usually about 3 ft. wide and 3 ft. 9 in. high. Desks, for the cashiers and tellers, are screened round with mahogany framing filled in with ground or figured glass. Stretched between the desks, and about 1 ft. from the public side of the counter, are brass screens or grilles attached to stout rods fitted to suitable standards. These screens should be 2 in. or 3 in. above the counter to allow of the passage of money, papers, or books, etc.

SCHOOLS.

In this instance the seats are combined with desks, and seats are made movable in such a manner that freedom is given to the scholar to stand up in front of his desk.

The frames are usually of cast iron, and the seats and desks of oak or maple, etc. The sizes made vary from a seat height of 11

inches and desk height of 20 inches to seat of 17 in with desk 29 ins., approximately. (The average age of the scholars in the class will, of course, determine the size of the desk.)

The width between the seats should be 2 ft. 3 in. from back to back for classes other than infants. The width for infants should be 2 ft. from back to back.

Desks are now usually made for either one scholar or two, the long desks being considered out-of-date.

Blackboards are now made either of large slates of ground plate glass on a black background, or slabs of slate. The surface should be rough enough to take the chalk and free from gloss. Glass boards have "lines" indicated by stretching bright wire or other cord under the glass. Lines are simply ruled on slate boards.

BAR FIXTURES.

Counters are usually made of mahogany, teak, or walnut, etc., with their tops either of the same material or of marble or glass. The fronts are panelled, or divided up by pilasters, and with skirtings at base and heavy mouldings at top under the counters, which should project 4 in. or 5 in. from the face of the panels. The height should be from 3 ft. to 3 ft. 6 in. above the floor level, and the counter top from 2 ft. 3 in. to 3 ft. wide. The inner side is divided up to suit the requirements of the trade. Convenient spaces should be also allotted for the sinks and draining boards, etc.

Stands for the exhibition of fancy cordials and sundries are amongst the necessities of the modern bar, the lower part being relegated to wines, etc. A counter of the same height as the serving counter is usually provided, and above this rows of narrower shelving, supported by light pilasters, arched over at the top, and finished near the ceiling with cornices. The backs are usually furnished with highly-polished bevelled mirrors.

BILLIARD AND POOL ROOMS.

Billiard rooms should have non-absorbent or sanitary floors. The tables should be arranged with ample room between and due regard paid to the lighting.

In clubs, billiard room seats should be raised on a step 7 in. to 9 in. from the floor level.

PUBLIC LIBRARIES.

The bookcases should be of solid material and should be provided with some form of shifting shelf, capable of being regulated to the sizes of the volumes. Iron shelves are now largely used, because they take up less room than wooden ones and are easily adjustable. The uprights should all be fixed at a like distance apart, and then the shelves, being movable, can be used anywhere in the library. The width of bookcase should be

about 15 in. One-fifth only of the books in an ordinary library being over 7 in. wide, the book backs should not touch. The lower part of book cases should be wider, and used for folios to a height of about 2 ft. 6 in., and by the setting back of upper part a convenient shelf is formed. An ordinary allowance for average books is nine to the sq. ft. If doors to the bookcases are provided they should of course be of glass. The glazed doors of bookcases often have diagonal and curved framing to prevent the horizontal lines hiding the titles of a row of books. The doors should slide, as those which do so take up much less room than folding doors. Wire netting doors are sometimes used in the lower portions and no doors in the upper. Ground floor stacks in reference libraries should not be more than 7 ft. 6 in. high. The top should be flush with the cornice capping so as to be readily dusted.

Metal-shelving systems are now meeting with considerable favor. They possess the advantage of (1) saving of space, (2) possessing great strength with a minimum amount of material, (3) ability to be arranged entirely self-supporting, (4) fireproof, and (5) economical.

The lending department should be also provided with ticket racks, or card indicators, formed of a number of narrow compartments for the reception of tickets, each one numbered. A width of counter of 2 ft. is wide enough. The front should be recessed to protect the skirting from toe-kicks.

Frames should be provided on the walls for lists of new books, etc., deep enough for a sheet of foolscap—i.e., 13 in.—to be affixed, and a table or shelves, on which catalogues may be consulted, should also be provided, unless the more modern card index is adopted.

The borrowers' counter should be about 3 ft. high and 2 ft. 3 in. wide.

Newspaper stands should be about 6 ft. high, with slopes of sufficient length to receive the journals of the day, or about 2 ft. 3 in. deep. For smaller periodicals the dimensions should be about 1 ft. less. These stands are of two kinds—single stands for ranging round walls, and double stands for the centres of the reading rooms.

Tables should be provided for magazines and weeklies, about 4 ft. 6 in. wide, with a rack down the centre, and allowing 3 ft. per person in length. In the reference department there should be large tables for readers.

CHURCHES AND CHAPELS.

In former times churches were provided with closed pews, fitted with doors to the passages. Modern ideas have abolished the pew and substituted open benches with backs, or more recently, plain opera chairs for the worshippers.

The best form of bench is that with back rail, filled in with light panelling, and having a small bookboard. Flush panelling is desirable towards the seat. Projecting mouldings should be avoided.

The seats should be about 1 ft. 7 in. from the floor, 1 ft. 2 in. wide in the clear, slightly sloping, and the back 2 ft. 8 in., open below the seats, to allow the floor to be swept. The

back should not slope more than 3 inches in 18 inches, and be free from projecting mouldings on the side to seat. The benches should be spaced 3 ft. from centre to centre. The usual length of seat allowed to each person is 1 ft. 8 in., and the benches should be spaced so as to be multiples of this. No bench should be longer than 20 ft., and any over 10 ft. open at each end.

Kneeling boards where required may be inserted a few inches from the floor, and about 4 in. wide, placed at a slight slope.

The book board should be 5 in. wide, and either inclined towards the seat back in front, or provided with a raised fillet along the edge.

Umbrella racks of metal are a great convenience, attached to the bench ends in the aisles, and should be provided with dish for the drippings, and a lift-up ring.

Hat accommodation should be provided by rails under the seat, by hat hooks under the book board, or by special wire fittings under the seats.

The choir stalls, when in two rows, should be placed on a platform of two heights, 4 in. at front seat and about 9 in. at back. The front bench from top of platform to top of book board would be 2 ft., and the back and middle benches 3 ft. The openings between bench ends should be 1 ft. for the lower bench, and about 1 ft. for the upper bench.

Suitable sizes for Litany desks are 2 ft. 5 in. high in front, and 2 ft. 7 in. at back, with 11½ in. book rest.

Lecterns should be 3 ft. 10 in. to book rest, and latter 10½ in. high on top.

Pulpits should be from 2 ft. 4 in. to 3 ft. 6 in. in diameter, and 3 ft. 3 in. high from floor of pulpit to book board.

Platforms or rostrums are gradually superseding pulpits; the size varies according to requirements, but they should be large enough to hold at least seven people seated in chairs. The height varies according as to whether there is a gallery and its height. They have usually open framing or railings round. In the centre is a book rest, as detailed under pulpit.

Altar tables are usually massive tables of plain but characteristic design, with solid legs and rails, and heavy top. They are usually from 6 ft. to 8 ft. long by 3 ft. wide, and about 3 ft. 1 in. to 3 ft. 6 in. high. A step of about 7 in. should be provided. Altar rails should be from 2 ft. to 2 ft. 3 in. high.

The front should be not less than 3 ft. 9 in. by 2 ft. 6 in. in diameter, and should stand on an ample platform of 6 in. rise, with a further 6 in. step on the west side.

SCRAPING AND POLISHING OF FLOORS.

Floors should first be scraped and sandpapered to an even and smooth surface with some well-known floor scraper and should be filled with a reliable paste filler.

After allowing paste filler to dry thoroughly, apply wax by means of a floor waxing and polishing device. If a high polish is desired, repeat operation. Reliable Wax is always clear and will not discolor wood.

BATTS LIMITED

OFFICE AND MILL:

368-388 PACIFIC AVENUE - WEST TORONTO, ONT.

- Products** We manufacture Veneered and Pine Doors, Staved Columns for exterior and interior use. Frames, Sash, Flooring, Pine and Hardwood Trim, Newel Posts, Balusters, Turnings, Stair material, etc.
- Newel Posts** In Quarter Cut Oak, Birch, Georgia Pine. Several designs always in stock. Special Newels to detail quickly made to order.
- Balusters** We carry a large stock of Verandah and Stair Balusters ready for immediate shipment, and we are well equipped for turning Balusters to detail.
- Sash** Our complete up-to-date Sash Machinery is turning out large quantities daily. All Sash are dove-tailed at the meeting-rail.
- Doors** We are specially well equipped in our Door department, having the best Door Machinery obtainable. In our Glue Room, we have a 100 ton Power Press, used exclusively on our Veneered Doors. Only thoroughly kiln dried White Pine is used for our Veneered Door cores. A large stock of Door Veneers in all the cabinet woods are always kept on hand.



B.L. No. 312, 1/4-Cut Oak



B.L. No. 319, 1/4 Cut Oak



B.L. No. 316, 1/4-Cut Oak



B.L. No. 314, 1/4-Cut Oak

This door is a favorite with a great many.

A beautiful and high-class design of inside door.

B.L. No. 312, 1/4-Cut Oak

Sizes in Stock	Satin Walnut or Birch	Ash	Plain Oak	1/4-Cut Oak
2 ft. 10 in. x 6 ft. 10 in.—1 3/4 in.	Price \$10.50	\$11.00	\$11.50	\$12.50
3 ft. 0 in. x 7 ft. 0 in.—1 3/4 in.	Price 11.25	11.75	12.25	13.25

B.L. No. 314, 1/4-Cut Oak

Sizes in Stock	1/4-Cut Oak	Pine
2 ft. 8 in. x 6 ft. 8 in.—1 3/4 in.	Price \$8.50	\$4.00
2 ft. 10 in. x 6 ft. 10 in.—1 3/4 in.	Price 8.50	4.25
3 ft. 0 in. x 7 ft. 0 in.—1 3/4 in.	Price 9.00	4.50

Continued on next page

Columns

High-Grade Staved Columns, manufactured in all kinds of wood, in any diameter or length are a speciality with us. A large stock of Columns always on hand, enables us to make prompt shipment. Our facilities for the execution of orders to special design are such that we can satisfactorily meet any requirement.

Illustrated Construction

Illustration No. 1 shows an end view of our Staved Column with Lock Joint. This Joint prevents the Staves from opening, and also increases the gluing surface. We use the best grade of waterproof glue obtainable.

Illustration No. 2 shows our method of connecting the Cap and Base to the shaft of our Stock Columns. Both ends of the shaft are bedded in Mastic Putty. This is our own idea and as far as we know, is not in use by any other manufacturer. By this means, it is impossible for water or moisture to get to the inside of our Columns.



No. 1

No. 2

Column Illustrations and Catalogue

Below we show six styles of Stock Columns. These are made of White Pine and can be supplied promptly at the prices quoted.

A complete Catalogue of our various lines will be mailed on request, and we particularly invite correspondence from Architects, Builders and Contractors, regarding special work.



B.L. No. 1

B.L. No. 2

B.L. No. 3

B.L. No. 4

B.L. No. 5

B. L. No. 6

Design B.L. No. 1

Length	Diameter—5-in.	6-in.	8-in.	10-in.	12-in.
4 feet.....	Price \$1.60	\$1.70	\$2.25	\$3.00	\$5.00
5 feet.....	Price 1.85	2.00	2.40	3.25	5.50
6 feet.....	Price 2.10	2.20	2.50	3.40	5.75
8 feet.....	Price .....	.....	3.10	4.20	6.75
9 feet.....	Price .....	.....	3.50	4.75	7.50
10 feet.....	Price .....	.....	3.75	5.00	8.00

Design B.L. No. 2

4 feet.....	Price \$1.60	\$1.70	\$2.50	\$3.35	\$5.75
5 feet.....	Price 1.85	2.00	2.65	3.60	6.25
6 feet.....	Price 2.10	2.20	2.75	3.75	6.50
8 feet.....	Price .....	.....	3.35	4.55	7.50
9 feet.....	Price .....	.....	3.75	5.10	8.25
10 feet.....	Price .....	.....	4.00	5.35	8.75

Design B.L. No. 3

4 feet.....	Price \$2.10	\$2.20	\$3.00	\$4.70	\$6.75
5 feet.....	Price 2.40	2.55	3.20	5.50	7.30
6 feet.....	Price 2.70	2.80	3.35	5.80	7.60
8 feet.....	Price .....	.....	4.10	7.70	8.70
9 feet.....	Price .....	.....	4.55	8.25	9.50
10 feet.....	Price .....	.....	4.90	8.60	10.05

Design B.L. No. 4

Length	Diameter—5-in.	6-in.	8-in.	10-in.	12-in.
4 feet.....	Price \$2.60	\$2.80	\$3.70	\$4.75	\$8.00
5 feet.....	Price 2.85	3.10	3.85	5.00	8.50
6 feet.....	Price 3.10	3.30	3.95	5.15	8.75
8 feet.....	Price .....	.....	4.55	5.95	9.75
9 feet.....	Price .....	.....	4.95	6.50	10.50
10 feet.....	Price .....	.....	5.20	6.75	11.00

Design B.L. No. 5

4 feet.....	Price \$3.10	\$3.35	\$4.20	\$6.10	\$9.00
5 feet.....	Price 3.40	3.70	4.40	6.90	9.55
6 feet.....	Price 3.70	3.95	4.55	7.20	9.85
8 feet.....	Price .....	.....	5.30	9.10	10.95
9 feet.....	Price .....	.....	5.75	9.65	11.75
10 feet.....	Price .....	.....	6.10	10.00	12.30

Design B.L. No. 6

	Diameter—10-in.	12-in.	14-in.
6 feet.....	Price \$6.80	\$8.85	\$10.60
8 feet.....	Price 8.70	9.95	11.95
9 feet.....	Price 9.25	10.75	12.90
10 feet.....	Price 9.60	11.30	13.55

Builders allowed 10% discount on above 8, 10 & 12 -in. columns, designs 1, 2, and 3 only.

The Wm. Rutherford & Sons Co. Limited

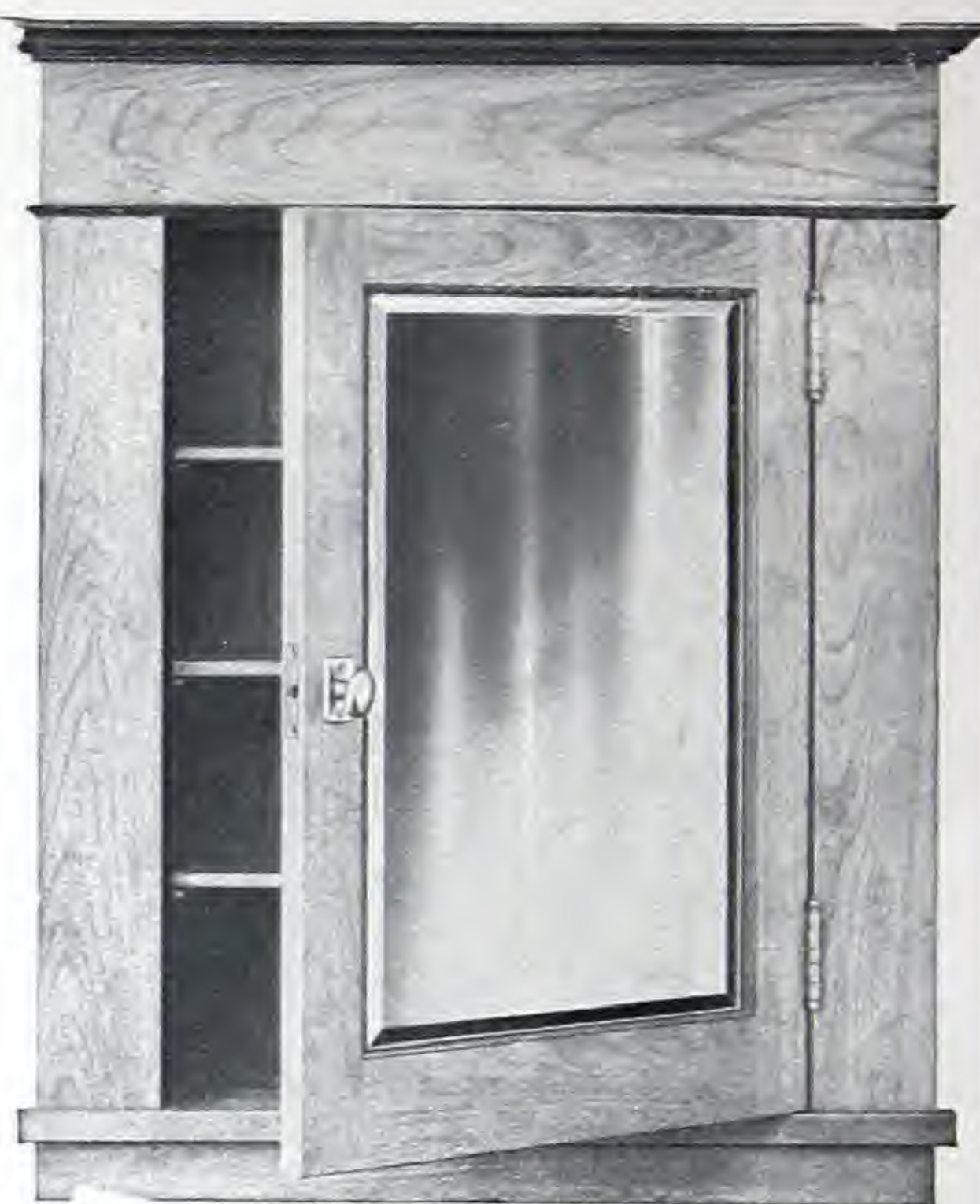
ATWATER and NOTRE DAME STREETS
MONTREAL, P.Q.

Products

STOCK MILLWORK, DOORS, STAIRWORK,
CUPBOARDS, Etc., FOR IMMEDIATE USE



Stair constructed entirely of Stock Material,
Birch or Plain Red Oak



DESIGN No. 1
Carried in Stock in Yellow Pine



Architects, Contractors and Dealers

This handsomely bound
Stock Millwork Catalog
Free for the asking.

Your Specification Data is
Not Complete Without It

Continued on next page

The Wm. Rutherford & Sons Co. Limited

ATWATER and NOTRE DAME STREETS
MONTREAL, P.Q.

THE LAST WORD IN DOOR CONSTRUCTION

KORELOCK

VENEERED DOORS



DESIGN No. 402

CARRIED IN STOCK
IN BIRCH AND OAK

From \$5.25 - - \$6.25

KLIMAX

FIR DOORS



DESIGN B 7

VENEERED PANELS
SOLID FRAMING

Price :: :: \$5.75

ILLUSTRATED LITERATURE and CATALOGUES FREE on REQUEST

H. M. LICKLEY, LIMITED

INTERIOR FITTING MANUFACTURERS AND GENERAL PLANING
MILL CONTRACTORS

Sawmill and Factory
GRAVENHURST, ONT.

TORONTO WAREHOUSE
139 Royce Ave.



Installed by us,

Private Room, Graphic Arts Building.

Circassian Walnut.

HIGH CLASS INTERIOR WOODWORK

Rough Lumber, Doors, Sash Trim

Interior Finish

We specialize in High Grade Interior Fittings of all kinds and woods, having a large stock of kiln dried lumber always on hand.

Rough

We carry a complete stock on hand of joists, studding, sheeting, Lumber, Etc. flooring, doors, sash, stair material and trim.

Hardwood Flooring always in stock.

Let us figure on your requirements.

THE JAMES SHEARER COMPANY, LIMITED

Established 1853

Office, Yards and Saw Mill

225 St. Patrick Street

MONTREAL, - - CANADA

General Contractors for Excavating, Concrete Work,
Brick Work and Carpentering
Specialty Factory Buildings

Lumber We carry a large stock of rough and dressed lumber, hardwood flooring, mouldings, shingles, lath, etc.

Timber Heavy Timbers for Derricks and other work in B. C. Fir, Long Leaf Yellow Pine and Oak; Spruce, Pine and Hemlock Timber.

Beaver Board Beaver Board is the modern substitute for plaster, and often replaces that material to great advantage, both in price and appearance of the finished wall. Samples and estimates of cost or prices per sq. ft. will be sent on request.

Prices Quotations on all materials will be cheerfully furnished on application.

Telephones	President and Managing Director	-	Victoria 1444
	Treasurer, Book-keeping and Secretary		Victoria 1443
	Inquiry and Order Departments	-	Victoria 1533
	Contracting and Order Departments	-	Victoria 1534

WEBB LUMBER CO., LIMITED

Dufferin & Van Horne Sts.

Phone Junction 3500

TORONTO, ONT.

Products Interior Trim, Veneered Doors, Sash Millwork, Stock Doors, Sash-Frames.

Hardwood Floors Hardwood Floors in $\frac{3}{8}$ and $\frac{7}{8}$ Oak; $\frac{5}{8}$ and $\frac{7}{8}$ Birch; $\frac{5}{8}$ and $\frac{7}{8}$ Beech; $\frac{3}{8}$ and $\frac{7}{8}$ Maple.

List **TRIMMING WOODS ALWAYS IN STOCK**
Air and Kiln Dried.

CANADIAN		PRICE	FOREIGN		PRICE
Ash,	(Black)	\$1.00	Ash,	(White)	\$1.00
Birch,	(Red)	1.00	Chestnut		1.00
Beech,	(Red)	1.00	Cypress,	(Red)	1.00
Butternut		1.00	Gumwood,	(Red)	1.00
Basswood	(White)	.75	Hickory		1.00
Cherry,	(Red)	1.00	Mahogany,	(African)	3.00
Cedar,	(Red)	1.00	Oak,	(Qtr. Cut)	1.50
Fir,	(Douglas)	1.00	Oak,	(Plain)	1.00
Maple,	(Birds Eye)	1.00	Pine,	(Yellow)	.75
Pine,	(White)	.75	Pine,	(California)	.75
Pine,	(Red)	.75	Redwood		1.05
Pine,	(Western)	.75	Walnut	(Circassian)	7.50
Sycamore,	(Red)	1.00	Walnut,	(Black)	2.00
Spruce,	(Silver)	.50	Whitewood,	(Poplar)	1.00

Special Prices for 10 inch and up in Hardwoods

How to Figure

The prices are based as follows:—

Thickness based on 1 inch for each additional $\frac{1}{4}$ in.— $\frac{1}{2}$ in. add 25% and 50% respectively.

1.00 per inch per foot run, for example,

1 pc. 1" x 4"—12' = 4.00 100 ft. = 48 cents

1 1/2" x 4"—12' = 6.00 „ = 72 cents

2" x 4"—12' = 8.00 „ = 96 cents

or, for every inch in width figure 1 cent per foot run.

Do not figure odd lengths and odd widths, example, a 1 x 5—13, should be figured as 1 x 6—14, or a 1 x 3 1/2—11 should be 1 x 4—12.

This is the correct way to figure for if you figure on the exact width and length, remember someone has to pay for the waste which might occur in ripping and cutting stock to your sizes, also from the fact that **Lumber** after going through the **Dry Kilns** invariably shrinks and twists, hence the reason for allowing for the waste, either in measurement or prices. **This is essential.**

Note

(1) Sash always in Stock.

Stock Sizes Open or Glazed

(2) Prices subject to Discount in quantities of 5 pair or more.

(3) Glazed Sash, carefully crated and primed, we guarantee against Broken Sash and Glass.

(4) Quality strictly No. 1, White Pine and first class workmanship

WEBB LUMBER CO., LIMITED

Dufferin and Van Horne Sts.

TORONTO,

CANADA

A Few Specialties in Wood

- Fir** British Columbia is to the West what White Pine is to the East. A soft textured wood free from gum and rosin and next to white pine is the easiest working wood, making it invaluable for working up. The figure is distinctive and is fully equal to ash, chestnut, or oak. We do not recommend imitation but if so desired this wood if dressed and finished properly can be made in appearance like any of the above mentioned woods.
It is the prettiest Interior Finish on the market besides being within reach of the ordinary house. Numerous rich decorative effects can be obtained, such as for panelling Dining Rooms, Halls, etc.
- Gumwood** The best substitute for Circassian Walnut known. Is extensively used by Furniture manufactureres under the name of "Satin Walnut" and is actually sold by some as Circassian Walnut.
The figure, texture and width is individuality in itself, making a superior Interior finish where beauty, individuality and taste is required. The price is quite reasonable, about the same as Chestnut, Ash or Fir.
- Black Ash** Makes a rich Hardwood finish, but like some other woods is becoming scarcer yearly. It will soon be as valuable as the rarer woods. White Ash grown in U. S. make a good substitute but not as small a grain nor is so closely figured as our Canadian Ash.
- Birch and Beach** Beautiful finishing woods particularly the Red Birch which is so often used to substitute Mahogany.
We think it absurd that these woods having such fine texture and coloring in themselves, should be used to imitate other woods which are by no mean superior to them.
- Red Wood** Grown in California, very much like White Pine in Texture and softness. Red in color. Can be finished natural or in fine Mahogany. Is not used extensively in Canada as yet but, owing to its superior qualities, we predict for it a great future.
- Service** A good assortment to choose from.
Delivery can be made promptly either from stock or special patterns.
- In Estimating** Figure your estimates based on the price listed and you will come out right. The listed prices are subject to **Builders Discount**.
Add \$1.25 for each separate detail to your figure.
- Guarantee** We guarantee **Workmanship, Quality, Delivery, Satisfaction**, or money refunded.

BLACK BUILDING SUPPLY COMPANY LIMITED

202 Mail Building

TORONTO - - - ONTARIO

Speciality Covert Improved Fireplace Throat and Damper (patented).
A throat and damper combined, which is an absolute necessity in proper fireplace construction.

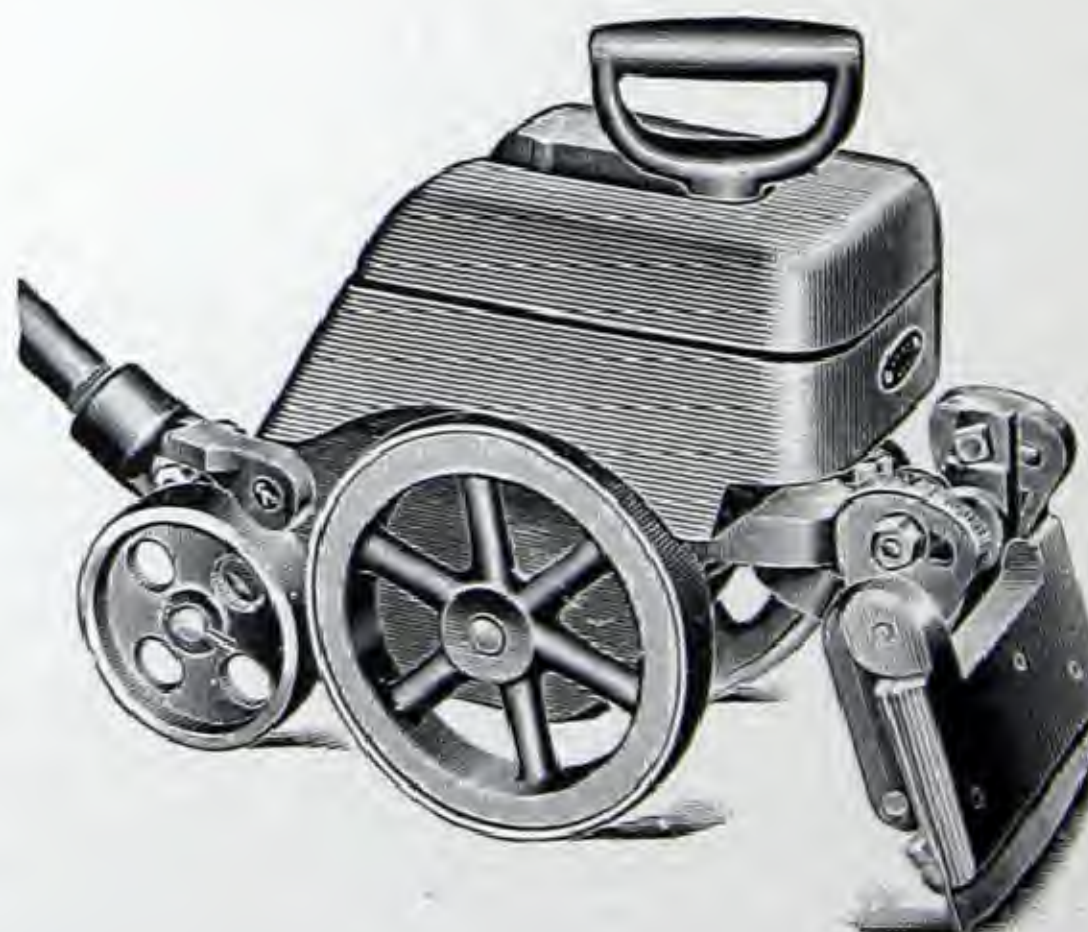


Construction This damper is of very simple construction, being made of four parts only, the body, which is of cast iron, the valve plate of rolled steel, the operating arm and pin. There are no worms or gears to get out of order and should mortar, brick or soot at any time clog the flue, the valve plate can at all times be entirely removed, allowing flue to be cleaned.

Specialty The Triple "A" Spring-Driven Floor-Smoothen. A machine that will successfully scrape and sandpaper to a perfect surface, wood floors of all descriptions.

Construction It is simple and practical, has a special Spring-driven motive power of its own and it is the most easily operated floor smoother on the market.

Correspondence We will gladly furnish on request, catalogues, estimates and information on the above subjects.



The Latest WEBER Work Savers

Every Carpenter Needs These Labor Saving Tools

Every one of these tools will produce a grade of work in less time—they are higher money savers, because they are time savers. No "botch" work with these modern, up-to-the-minute tools—no carpenter can afford to be without them. Look them all over and read the short description, then write us for catalog and prices. Ask all the questions you want to.

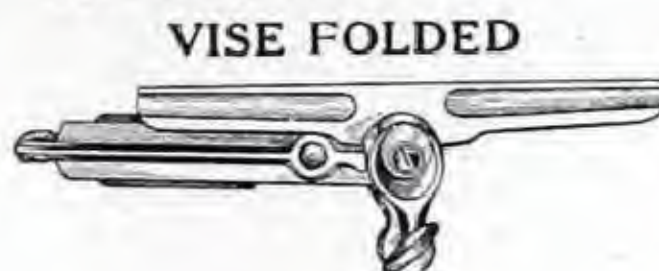


WAX POLISHER AND SANDER

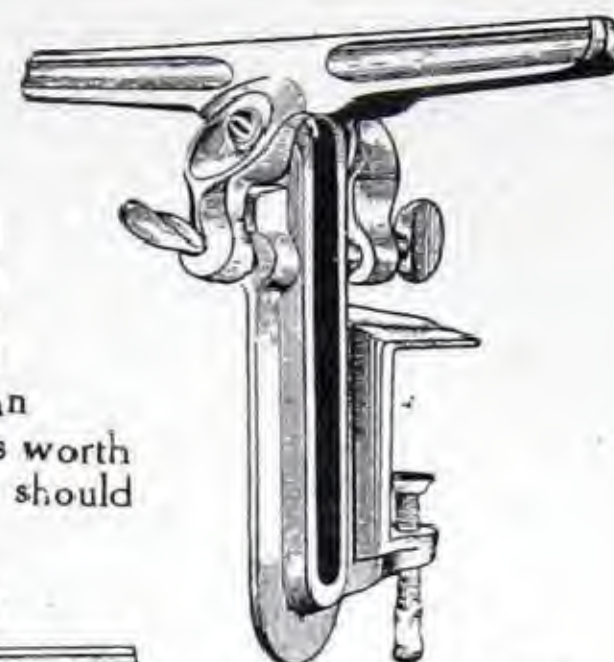
Brush sits square and even, imparting a high gloss. Sand paper attachment admits turning paper half around, greatly lengthening its life.

FOLDING SAW FILING VISE

Can be thumb-screwed to any bench—holds saw in rigid grip, and is nearly noiseless. When folded takes up no more room than an ordinary hammer. It is worth many times its cost and should be in every kit.



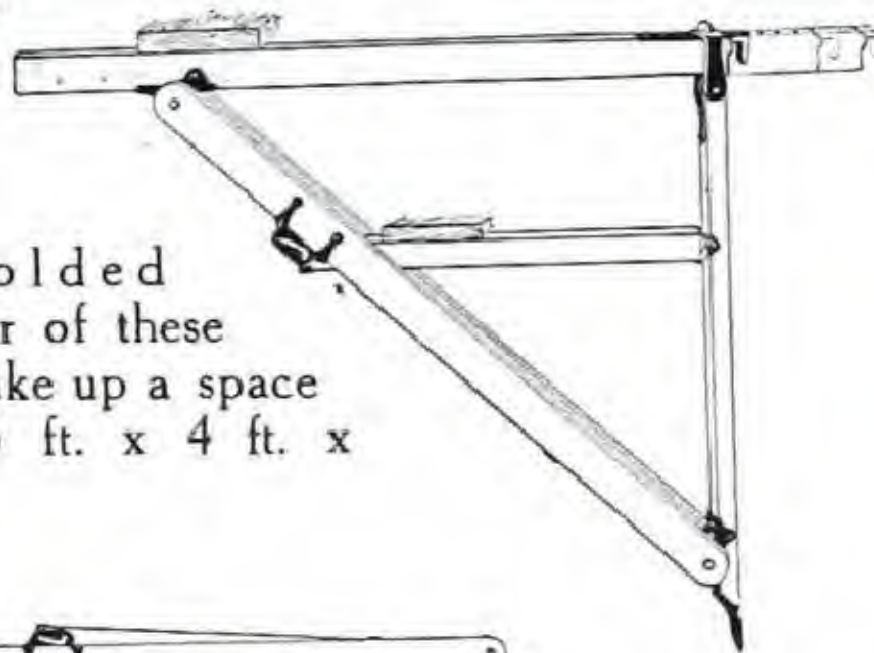
WISE FOLDED



WISE OPEN FOR USE

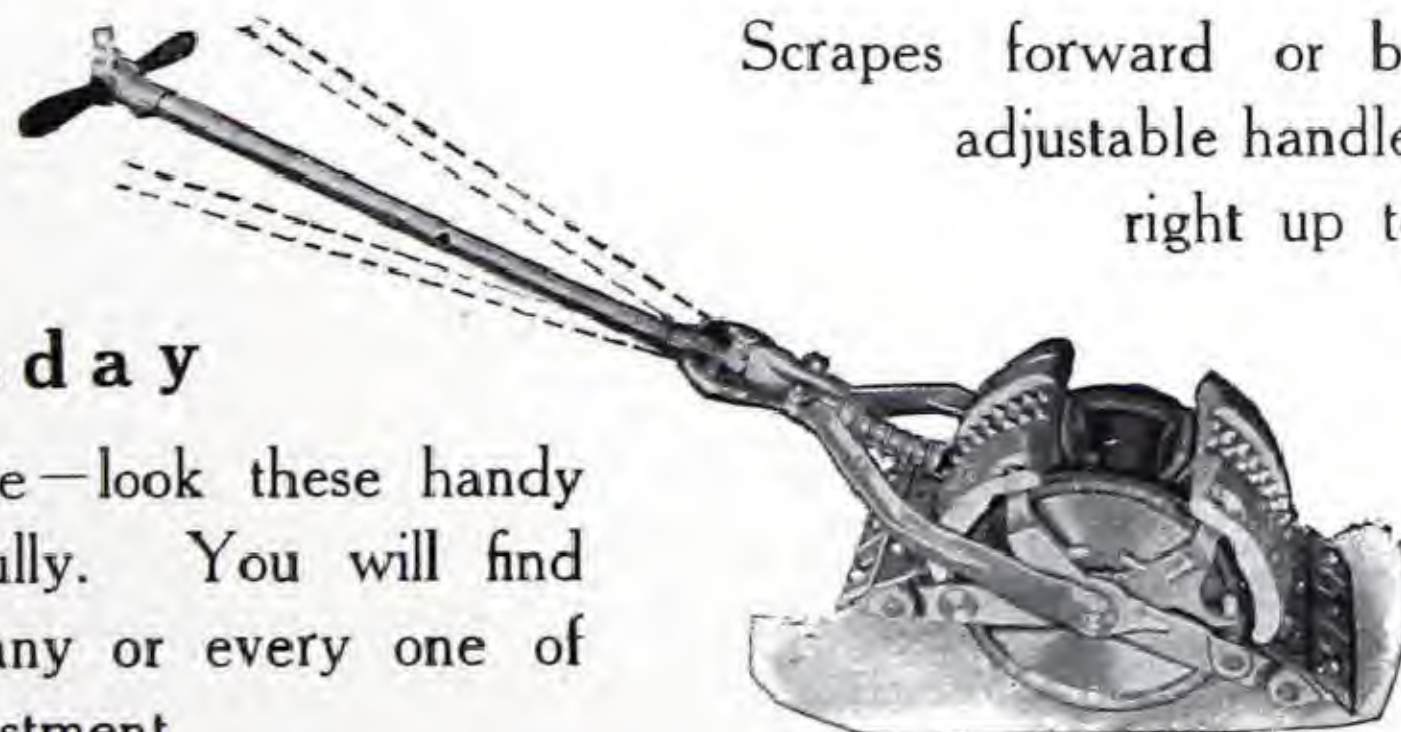
DOUBLE FOLDING SCAFFOLD BRACKET

Adjustable to any building—positively can not swing. When it ordinarily requires three rows of scaffolding, with the Weber it requires but two. When folded twenty-four of these brackets take up a space of only 3 ft. x 4 ft. x 6 ft.



SCAFFOLD FOLDED

The WEBER DOUBLE ACTING Floor Scraper



Write to-day

Get our Catalogue—look these handy articles over carefully. You will find the purchase of any or every one of them a paying investment.

Scrapes forward or backward. The adjustable handle permits scraping right up to the wall. We guarantee satisfactory work on all flooring without waves or chattering.

Weber Manufacturing Co.

677-71st Ave.

West Allis

Wisconsin

HARDWARE SPECIFICATIONS

(Owner Supplies Hardware.)

The rough hardware, such as nails, screws, sash pulleys, sash chains (or sash cord), sash weights, anchors, screw bolts, sliding door hangers, etc., shall be furnished by the contractor, and at his own cost, as specified in connection with the carpenter work or otherwise; all of which shall be of standard quality approved by the architect.

The finishing hardware, including butts, locks and their trim, and the other fastenings and metal work for doors, windows, closets and cabinets, will be furnished by the owner, delivered at the building in the quantities and at the times reasonably needed by the contractor; the contractor to be responsible therefor after delivery and until completion of the building. All finishing hardware is to be properly fitted and applied in place by the contractor, under the direction and to the satisfaction of the architect. Door knobs after being fitted in place are to be kept covered with cloth until the building is completed, to protect them from injury by handling.

The contractor shall furnish the manufacturer or dealer from whom the finishing hardware is purchased with all information as to the details of wood work which may be necessary or desirable to enable the party furnishing the finishing hardware to understand the requirements and to harmonize the hardware with the cabinet work to such extent as may be necessary and feasible, and, where interferences are discovered, to have them adjusted before the hardware is supplied.

(Contractor Supplies Hardware.)

The rough hardware, such as nails, screws, sash pulleys, sash chains (or sash cord), sash weights, anchors, screw bolts, sliding door hangers, etc., shall be furnished by the contractor, and at his own cost, as specified in connection with the carpenter work or otherwise; all of which shall be of standard quality approved by the architect.

The finishing hardware, including locks and their trim, butts, door bolts, window and shutter fastenings, catches, hooks, etc., including therewith knobs, escutcheon plates, and other metal trim for doors, windows, closets and cabinet work, together with all necessary screws therefor, shall also be furnished by the contractor (for the wood work).

This finishing hardware shall conform absolutely as to maker, catalogue number, design, size, metal, finish, quality, to the following specifications.

(Here should follow a full description of the hardware selected, which may be specified by rooms, openings, or in any way that will best meet the conditions.)

The quantities of such hardware required will be ascertained by the contractor from

the plans and specifications, and shall be such as to provide the proper fastenings and trim for all doors, windows, closets and cabinet work, in conformity with the intent of the plans and specifications.

The contractor shall take charge of, and be responsible for, such hardware when and as delivered at the building by the manufacturer or dealer by whom supplied. At the proper time the contractor, in a suitable and workmanlike manner, shall fit and apply the hardware in place, to the satisfaction of the architect and subject to his approval, being responsible for its proper care and protection until the building is completed and is accepted by the owner.

The contractor shall furnish the manufacturer or dealer, from whom the finishing hardware is purchased, with all information as to the details of wood work which may be necessary or desirable to enable the party furnishing the finishing hardware to understand the requirements and to harmonize the hardware with the cabinet work to such extent as may be necessary and feasible, or, where interferences are discovered, to have them adjusted before the hardware is made.

The decision of the architect concerning any and all disputes arising under this contract relating to the finishing hardware or its application, shall be final and binding upon the contractor.

ALTERNATIVE.

If selection can be left party to the contractor the following clauses may be incorporated with the above.

The finishing hardware required in the building shall conform absolutely as to size, metal, finish and quality, and as to design where indicated, to the following specifications.

(Here should follow a full and accurate description of the hardware, by items, "combinations," or rooms, the important details of each article being so fully specified as to secure the desired kind and quality and to exclude inferior and cheaper substitutes.

DESIGNS.—These shall be subject to selection or approval by the architect from among the stock patterns of manufacturers

METALS AND FINISHES.—The hardware for all main portions of the house to be of solid cast bronze or brass, gold plated for parlor and library, silver plated for dining room, and elsewhere in the natural color, polished. In the service portions to be bronze metal, polished.

GENERAL.—All hardware required shall be of standard quality and sizes, conforming in metal and finish to the other, hardware of room in which used, and subject to selection or approval by the architect.

HARDWARE COVERED BY FIXED ALLOWANCE.

THE FINISHING HARDWARE.--The contractor (for the cabinet work) shall reserve the sum of \$ to be expended, under the direction of the architect, for the finishing hardware, including therein all locks and their trim, butts, door bolts, window and shutter fastenings, catches, hooks, etc., and including therewith knobs, escutcheon plates and other metal trim for doors, window closets and cabinet work, together with all necessary screws therefor, in such quantities as may properly be required for the complete equipment of the building in accordance with the intent of the plans and specifications, and to the satisfaction of the architect. The contractor shall fit and apply in place all of said finishing hardware, in a neat and workmanlike manner, to the satisfaction of the architect and subject to his approval, and shall be responsible for its proper care and protection until the building is completed and accepted by the owner.

All of the finishing hardware so required shall be selected or approved by the architect, and no such hardware shall be used, save by the consent in writing thereto of the architect.

The finishing hardware shall all be of the best kind and quality obtainable within the limit of the allowance above stated, a proportionate deduction from the above contract price to be made if the actual cost, at fair market prices, of the hardware selected and finally approved by the architect (with ten per cent. added to such cost), does not equal the above stated allowance; the right being hereby specifically reserved to the owner of selecting and using finishing hardware of better quality or higher cost than herein contemplated upon condition that, in such case, the owner shall pay to the contractor such additional amount as, with the sum stated above, shall equal the actual cost, at fair market prices, of the finishing hardware so selected, with ten per cent. added to such cost to cover the contractor's work in applying the hardware. The contractor shall furnish the manufacturer or dealer, from whom the finishing hardware is purchased, with all information as to the details of woodwork which may be necessary or desirable to enable the party furnishing the finishing hardware to understand the requirements and to harmonize the hardware with the cabinet work to such extent as may be necessary and feasible, or, where interferences are discovered, to have them adjusted before the hardware is made.

W
H
O
L
S
A
L
E*Aikenhead's*R
E
T
A
I
L

HARDWARE SOLD BY AIKENHEAD IN QUALITY HAS ALWAYS LED

THE MOST COMPLETE AND UP-TO-DATE STOCK OF
BUILDERS' HARDWARE

IN CANADA

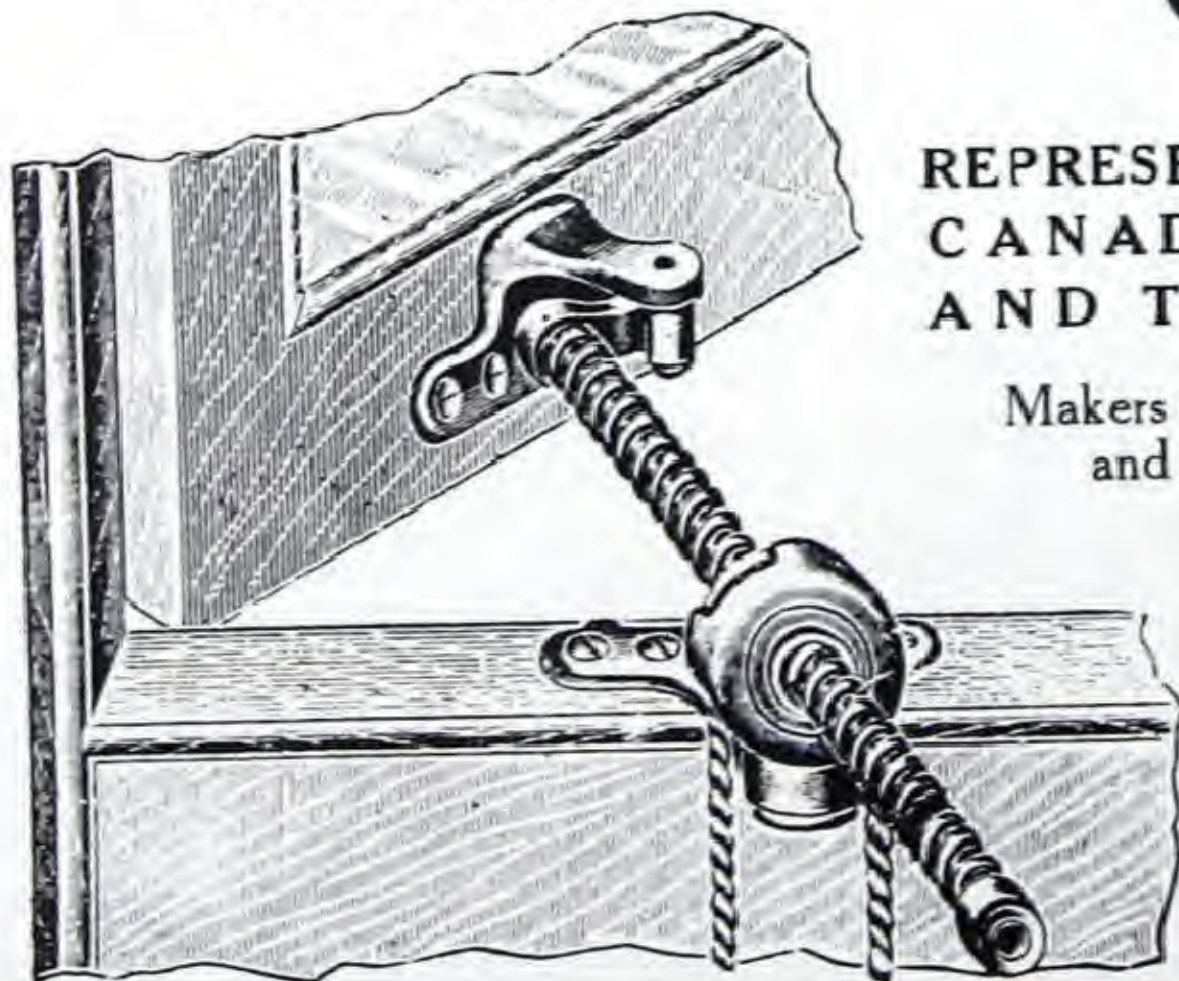
CUT GLASS KNOB

YALE FRONT
DOOR SET

DOOR HOLDER

WE CARRY THE
TAYLOR PORTABLE
STEEL DERRICKWeight, 196 lbs. Capacity, 1900 lbs.
CAN BE OPERATED BY ONE MAN.

CASEMENT ADJUSTER

REPRESENTING THE
CANADIAN YALE
AND TOWNE CO.Makers of Yale Locks
and HardwareMECHANICS' TOOLS
CONTRACTORS' SUPPLIES

YALE PADLOCK

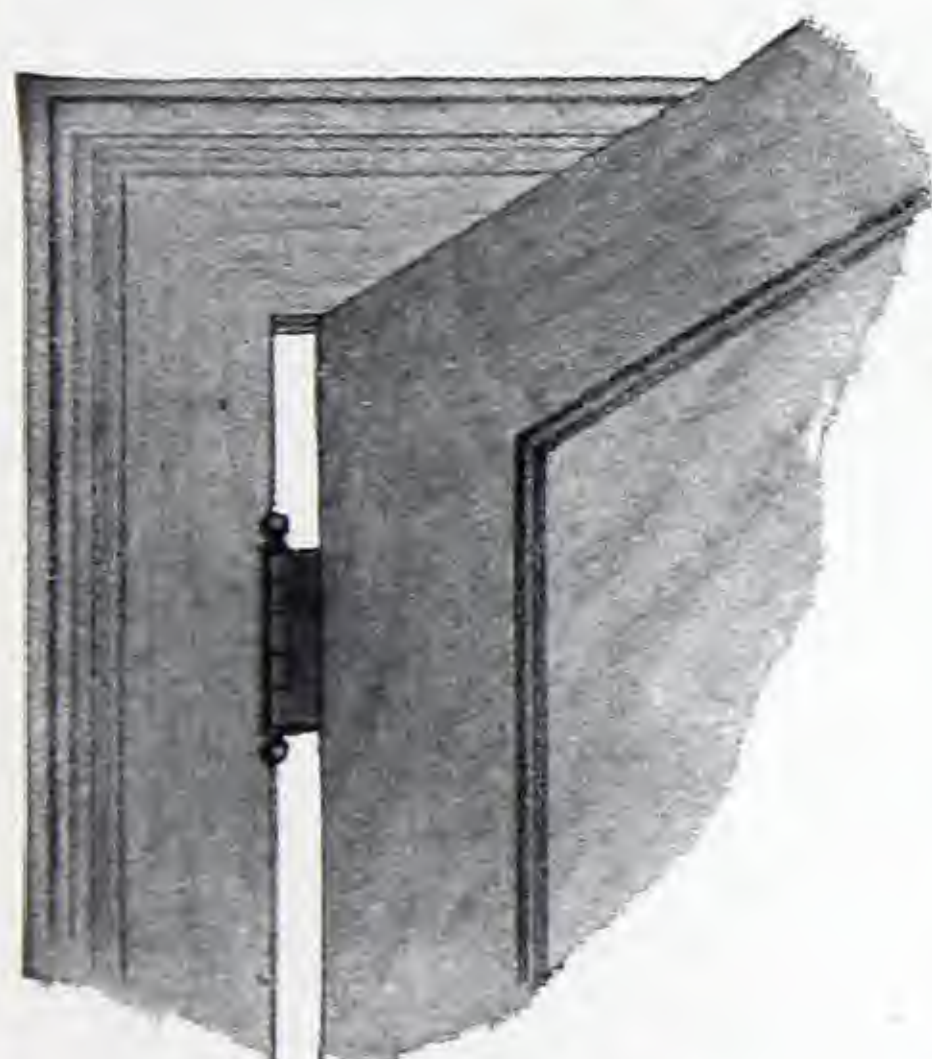
**AIKENHEAD HARDWARE LTD.**17, 19, 21, TEMPERANCE STREET
TORONTO - CANADA

SOSS INVISIBLE HINGE CO. LIMITED

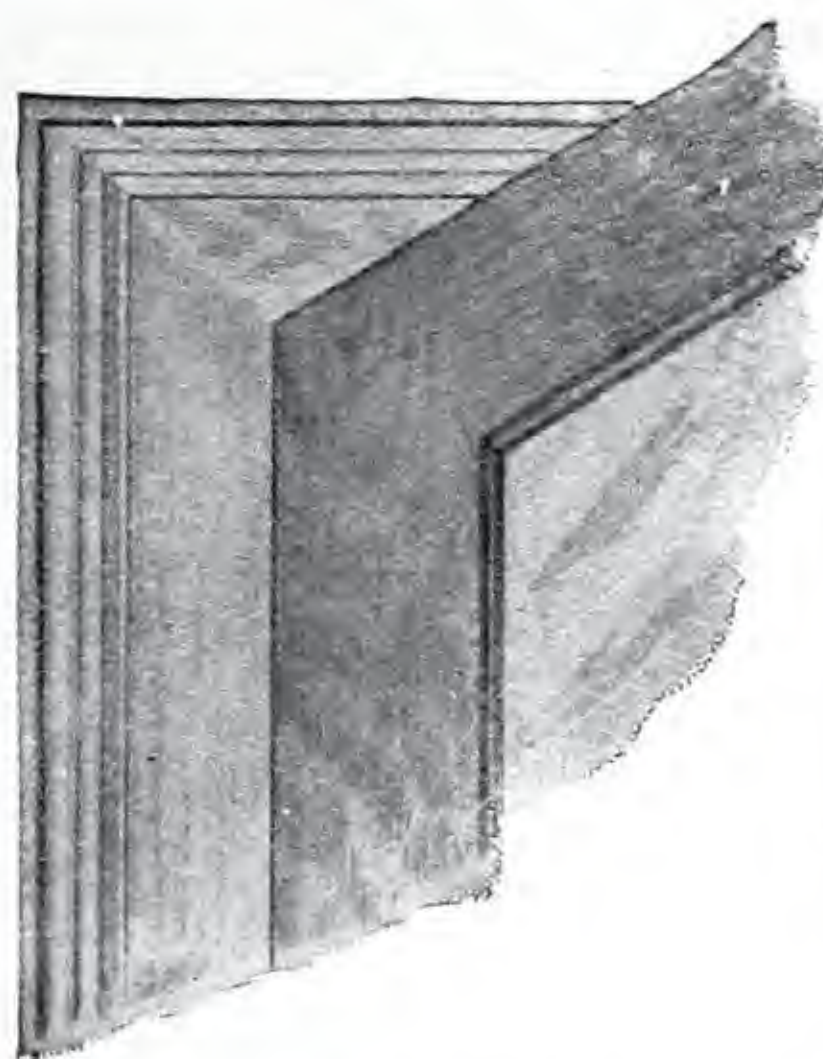
104 BATHURST ST., TORONTO

Products We manufacture the "Soss" Invisible Hinge, protected under patents in U.S. and Canada, and are prepared to furnish same in all sizes, from those suitable for Cabinet Work to such as are required for heavy entrance doors.

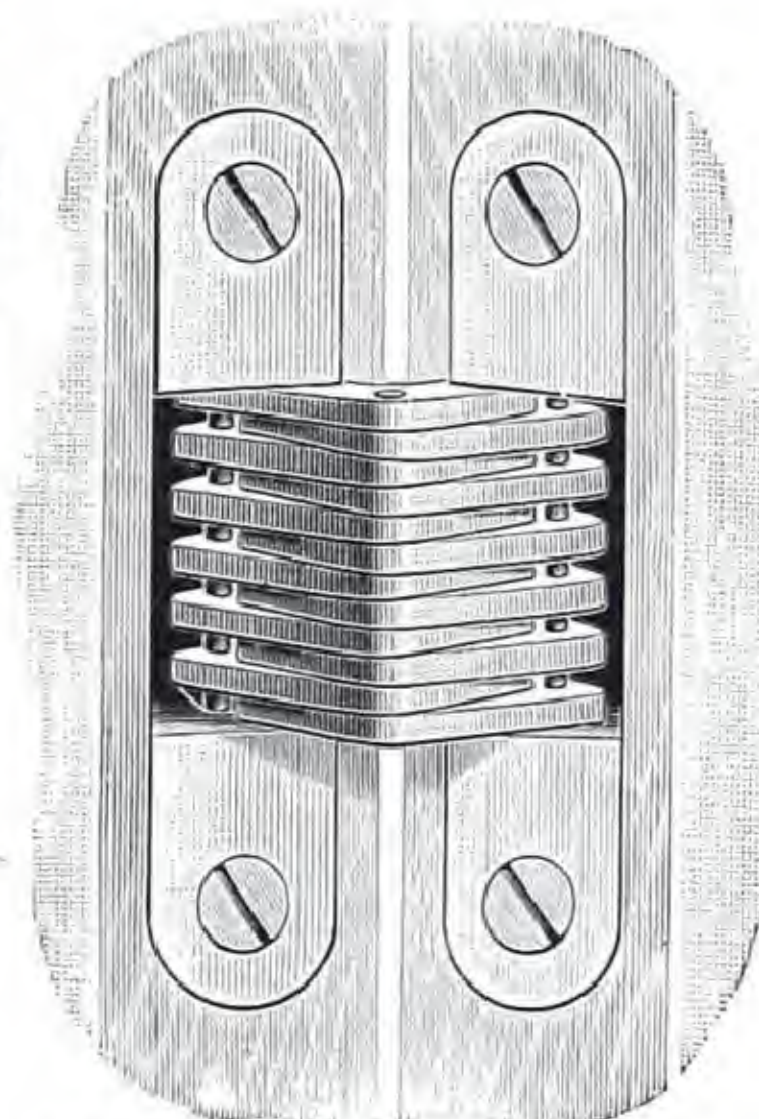
Comparisons There was a time when doors were swung on hinges and fastened by bolts and locks of very crude workmanship. As improvements advanced, the locks were put out of sight and "Mortise Locks" have been in use in good buildings for many years. The hinge, however, remained much the same, after reaching what is known as the "Butt" until the introduction of the "Soss" Invisible Hinge, which is as great an advance in its way as the mortise lock was over the old-fashioned lock fastened on the outside of the door. The cuts below illustrate the invisible hinge as compared with an ordinary Butt hinge.



Door Mounted with old-fashioned Butt



Door Mounted with Soss Invisible Hinge



Invisible Hinge as it appears when door is open

No. 101—Suitable for wood $\frac{1}{2}$ inch to $\frac{3}{4}$ inch thick (furniture work). Will carry door 3 feet x 18 inches.

No. 102—Same as above but has square corners.

No. 104—Wood must be $\frac{3}{4}$ inch. Will carry door 5 feet x 2 feet x $\frac{7}{8}$ inch.

No. 108—Wood must be $\frac{7}{8}$ inch. Will carry door 6 feet x 2 feet 6 inches x $1\frac{1}{2}$ inches.

No. 112—Wood must be $1\frac{1}{8}$ inches to $1\frac{1}{2}$ inches. Will carry door 6 feet x 2 feet 6 inches x $1\frac{1}{2}$ inches.

No. 116—Wood must be $1\frac{3}{8}$ inches to $2\frac{1}{2}$ inches.

Stop Hinges We can supply any size hinge to stop at any angle desired, but same must be made up especially and at an extra charge.

Stock Carried We carry in stock hinges in sizes as above in Brass, Bronze, Nickel and Oxidized Copper.

Prices on application to all leading Hardware Dealers

THE TISDALE IRON STABLE FITTINGS CO. LIMITED

364-370 Richmond Street West,

TORONTO, - - - - - ONT.

Product Cast and wrought iron, brass, bronze and nickel plated stable fittings.



Illustration We have here illustrated Sir H. M. Pellatt's stables, Toronto. Architect, E. J. Lennox, Esq., Toronto.

Catalogue Our Catalogue "H" fully illustrates a complete line of first-class stable fittings. We would be glad to mail a copy to Architects and others who may be interested.

Estimates We would be pleased to furnish estimates and drawings for any special requirements.

FIREPROOF DOORS AND SHUTTERS

WOODWORK.

Core to be made of well seasoned white pine or similar non-resinous wood. Stock to be of a good sound quality, practically free from sap and large or loose knots. Boards to be plain (not beaded), to be tongued and grooved, dressed on both sides, and not to exceed 8 inches in width. Finished thickness of boards to be 13/16 inch full.

Door to be made of three thicknesses of boards dressed to 13/16 inch (full), the outside layers to be vertical and the inner layer horizontal.

Layers to be securely fastened together by wrought iron clinch nails driven in flush and clinched so as to leave smooth surfaces on both sides of the door. Vertical and horizontal rows of nails not to exceed 8 inches apart, placing the outer rows near the edges of the door.

Care should be taken to have all edges and corners smooth and square.

TIN COVERING.

The fire resisting value of a wood door encased in tin depends upon the exclusion of oxygen from the wood, thereby retarding or preventing combustion, and also upon the degree to which bulging in the covering can be prevented when the door is exposed to fire. To obtain these results the covering must be so applied that the joints between the plates will remain intact and provision made for the escape of the gases generated from the wood core. In covering the door follow carefully every specification given below.

Prime terne plate 16 thickness and 14 x 20 inch size to be used. Finished plate to weigh not less than 113 lbs. net per box of 112 sheets, including at least 10 lbs. of coating. Black plate to be of best quality basic open hearth soft steel or charcoal iron, weighing 103 to 105 lbs. per box of 112 sheets before coating. Coating to be of an alloy of not less than 25 per cent. pure new tin, nor more than 75 per cent. pure new lead, applied by the pure palm oil process, no acid flux or flux of any kind other than palm oil being used. Plates to be re-squared.

The above requires a thoroughly good quality of plate, not excessive in price, but will bar out wasteful and miscellaneous plates of doubtful quality sold on a mere basis of weight.

All joints to be locked full 1/2 inch, as illustrated in Figs. 15, 16, 17 and 18. To be nailed under seams except at cross seams in marginal covering of door where no nails are necessary. Nails to be placed in center of vertical joints and as close as possible to the standing plates in the horizontal joints, without breaking through the metal when the plates are turned down.

The lock in the joints means the distance between the cut edge of one plate to the cut edge of the opposite plate. In order to secure the full 1/2 inch lock between the plates, the edges should be turned up 9/16 to 5/8 inch. Nails placed near the edges of the plates are easily torn through by the strains due to bulging when the door is exposed to fire. The

above rule should be carefully observed when it is necessary to bend the plates by hand.

Cover four corners first. For each corner of door use a whole sheet of tin without cutting, making a mitre fold instead of a mitre joint or seam, driving two nails under each fold.

Next cover the edges with sheets of the same size (or long strips, if preferred) and lock into corner pieces with a joint like Fig. 18, but without nails. (See Fig. 23.)

Then apply both side sheets, starting with first sheet at right-hand lower corner. (See Figs. 24 and 25.) Then all horizontal seams, when completed, will be like Fig. 18, except the last seam at the top of the door, which will be like Fig. 16. All vertical seams will be like Fig. 16.

Where the door is provided with a segmental head, the cap shown in Fig. 26 may be used.

Complete the tinning of one side before beginning the other side.

Nails to be No. 12 1/2 or 13 gauge, flat head, full barbed wire nails, 2 inches long. Use five nails on each side and four on each end of each sheet, nails being placed close to but not at the corners.

Care should be taken to have sheets as flat against door as possible in order to avoid air spaces.

When the covering is complete cut a hole three or four inches in diameter through the middle plate on the exposed side of the door, but not through the wood core. Secure the tin around this opening with small nails and thoroughly paint the wood thus exposed.

Note.—the hole will prevent bulging of the covering and rupture of the joints by permitting the escape of gases generated from the wood core when the door is exposed to fire. Care should be taken to ascertain which is the exposed side of the door before the hole is made. Usually the hole should be made after the door is mounted. Three inch holes should be made for doors under fifty square feet in area and four inch holes for doors in excess of fifty square feet.

HARDWARE FOR SLIDING DOORS— MOUNTING.

The following rules cover the track, chafing strips, and the essential points of setting up doors and mounting the hardware. The door should be completely tinned before the hardware is attached and only such hardware as has been examined and tested and found satisfactory should be used.

Track.

To be made of best quality rolled steel of ample cross section.

Length to be equal to twice the width of the opening, plus 21 inches.

Tyre steel or steel having rounded edges is recommended, as it presents less resistance to the operation of the door.

Attention is called to the fact that the length of the track is given in terms of the wall opening, 12 inches being allowed for the lap and width of the door, 8 inches for attaching front and back bumpers, and 1 inch for clearance when the door is wide open.

To be such that a wall bolt will be located directly opposite each hanger when the door is closed and also for attaching front and back bumpers.

To have an incline of $\frac{3}{4}$ inch to one foot when mounted.

Doors for opening in excess of 6 feet in width require three hangers.

Never attach track to wood frame even if frame is tin clad, and never use wood or lead plugs in the wall to support wall bolts.

Number of Hangers.

Doors for openings six feet and less in width to be provided with two hangers. Doors for openings in excess of six feet to have three hangers.

Bumper Shoes.

Four necessary, one opposite each bumper and one opposite each binder. To be fastened to the edges of the door by $1\frac{1}{4}$ inch wood screws.

The front and back bumpers are mounted with the track.

Handles.

Flush pull on back of door to be counter-sunk flush with the surface of the door. Heavy bow-shaped handle to be attached to front of door. Handles to be bolted together through the door or otherwise securely attached.

Bolts and Washers.

Bolts for track, binders, and stay roll to be $\frac{3}{4}$ inch in diameter, to extend through the wall and to be provided with washers 4 inches in diameter on opposite side of the wall. (See Figs. 28 and 29.)

Where the above members are bolted together through the wall the washers are unnecessary.

Use $\frac{5}{8}$ inch bolts in attaching stay roll shown in Figs. 1, 4, 5, and 28 to the steel work of the sill.

Wall Eyes.

Wrought iron for $\frac{3}{4}$ -inch pin, built in wall or bolted through wall with $\frac{3}{4}$ -inch bolt, with $\frac{3}{16}$ -inch iron washer each side. Bolts should always be put through brick work far enough from edge of opening to prevent weight of door loosening the masonry.

Hinge.

To be of wrought iron or steel $2\frac{1}{2} \times \frac{3}{8}$ inches, to be bolted to the door with four $\frac{3}{8}$ -inch bolts and to extend three-quarters of the way across the door. Doors in excess of seven feet in height or six feet in width to be provided with three hinges.

Latches.

Doors to be secured by at least three latches of $1\frac{1}{2} \times \frac{3}{8}$ -inch iron, working together. Upper and lower latches not to exceed twelve inches from upper and lower edges of the door opening.

To be operated from either side of the door, to swing freely on $\frac{3}{8}$ -inch bolts through the door, to be provided with proper keepers bolted through the door and with a spring to insure latching.

Catch.

To be made of heavy wrought iron built in wall, bolted through, or bolted to wall frame, and so designed as to permit the latches to freely enter.

Attaching Hardware.

Hinges, latches and keepers to be secured by machine or carriage bolts passing through the door. Heads of bolts to rest against washers next the tin, the nuts being against the steel members.

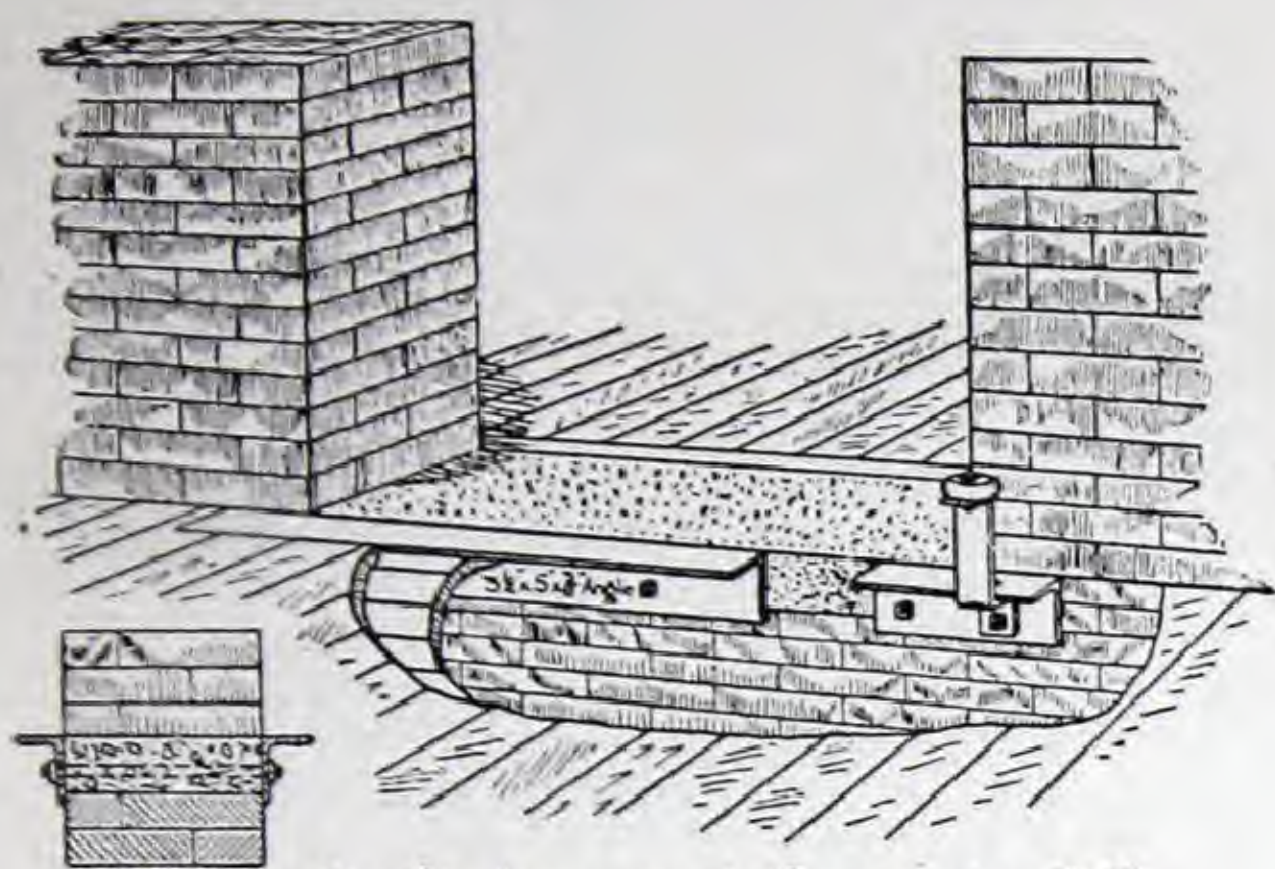


Fig. 1. Angle Iron and Concrete Sill.

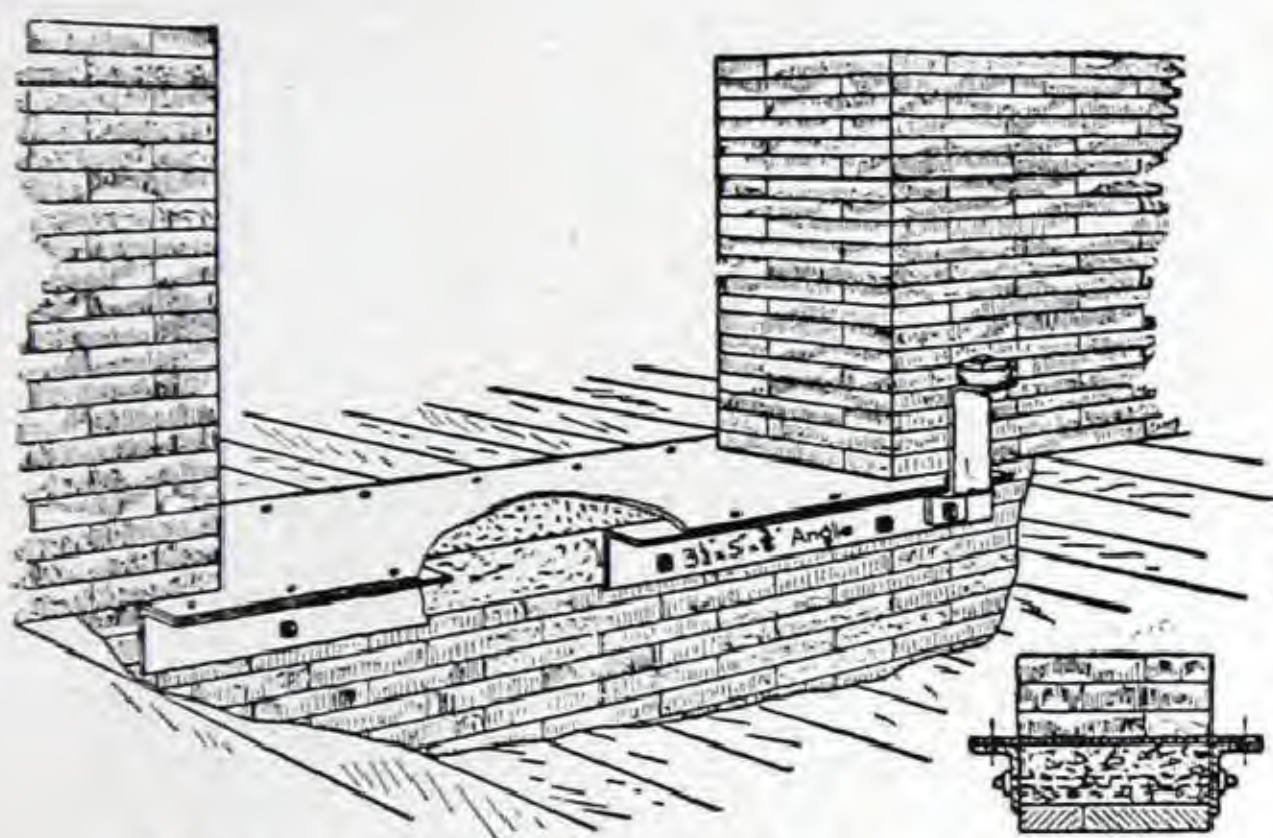


Fig. 2. Angle Iron and Concrete Sill, with Plate on Top.

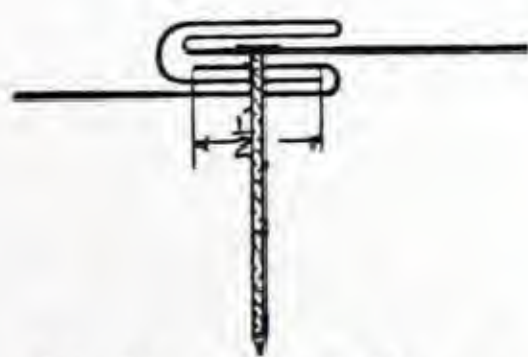
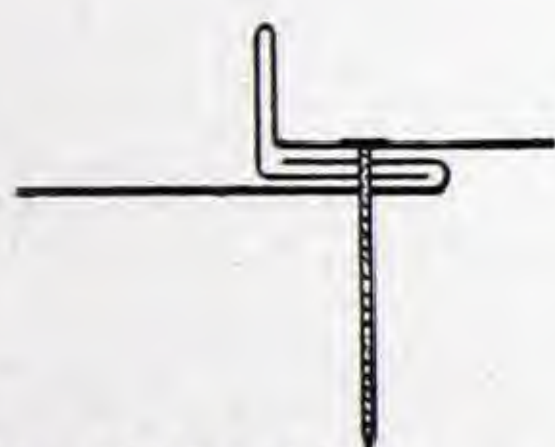


Fig. 15. Third Process. Fig. 16. Finished Seam.

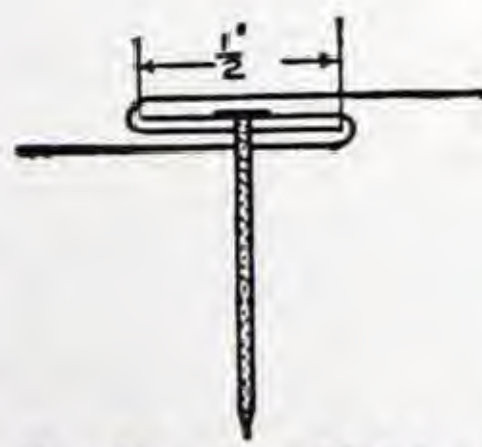
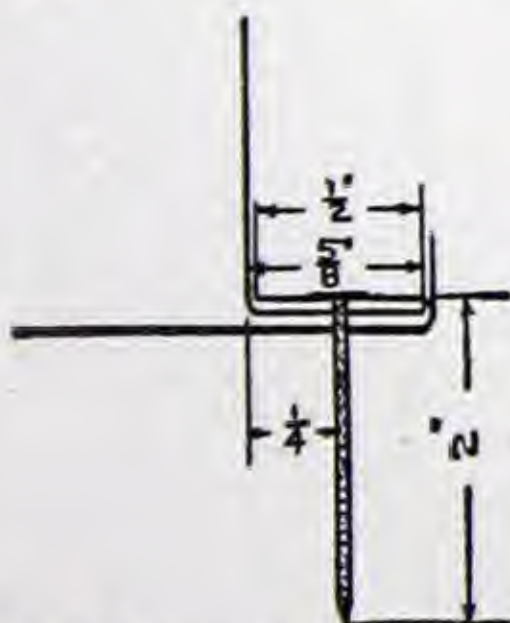


Fig. 17. While Being Nailed. Fig. 18. Nailing Finished.

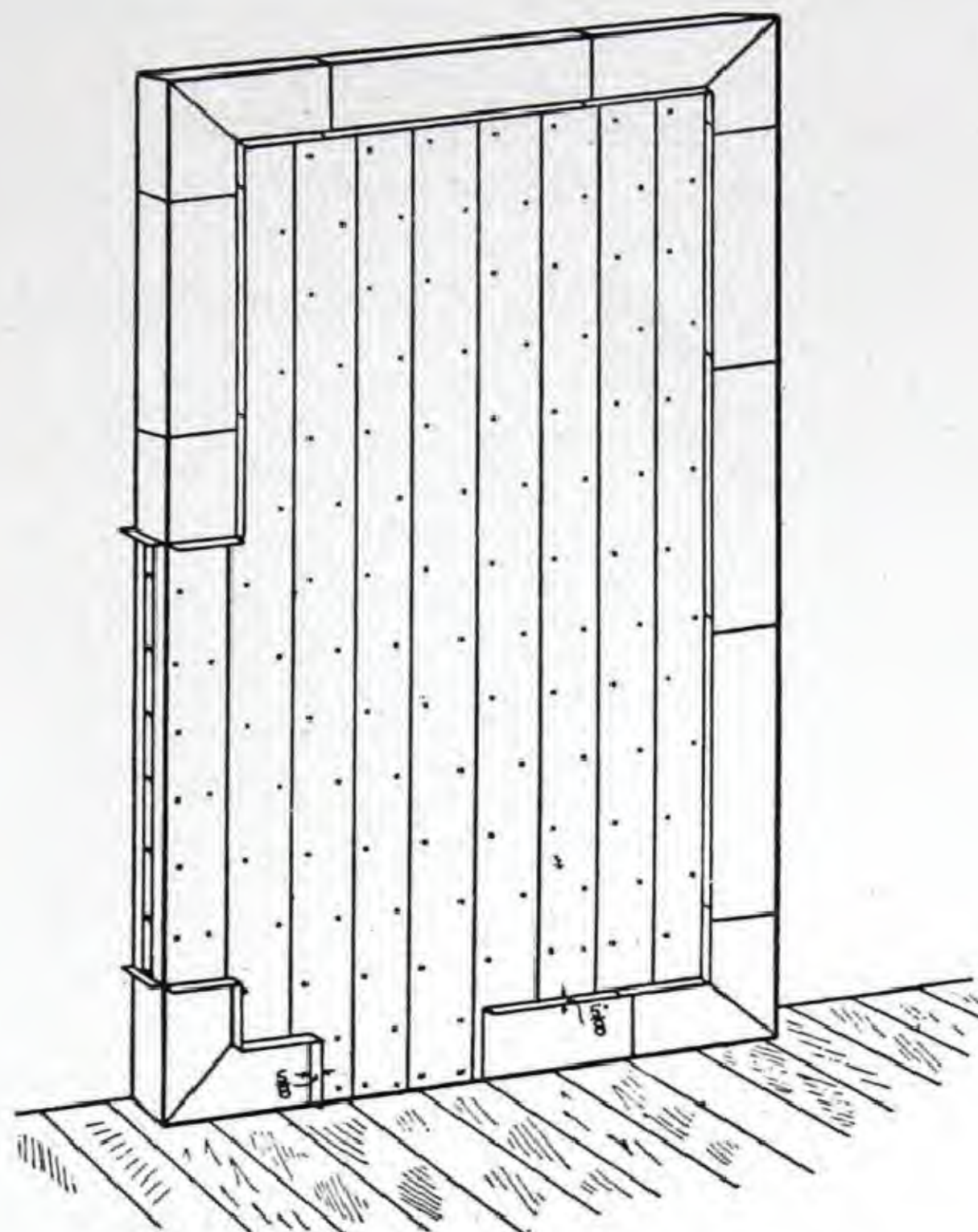
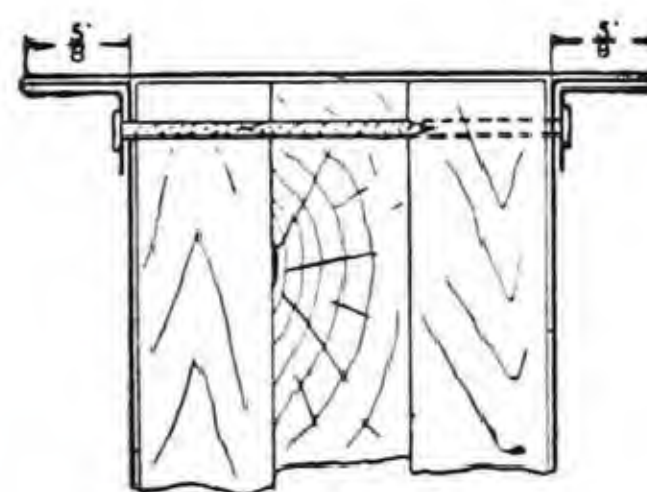
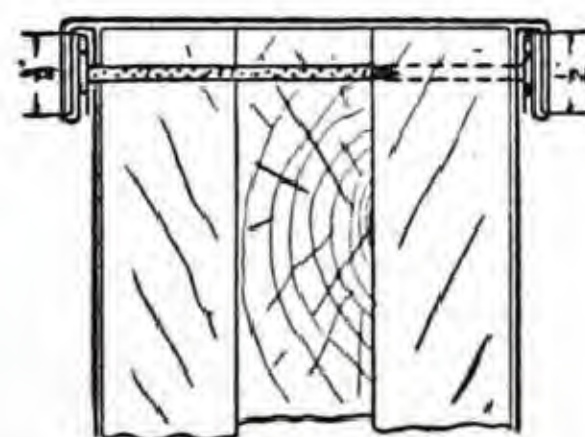


Fig. 23. Covering at Edges of Door Showing five eighths inch Edge standing out from Door.



First Process.



Finished Seam.

Fig. 26. Approved Form of Cap Covering Segmental Head.

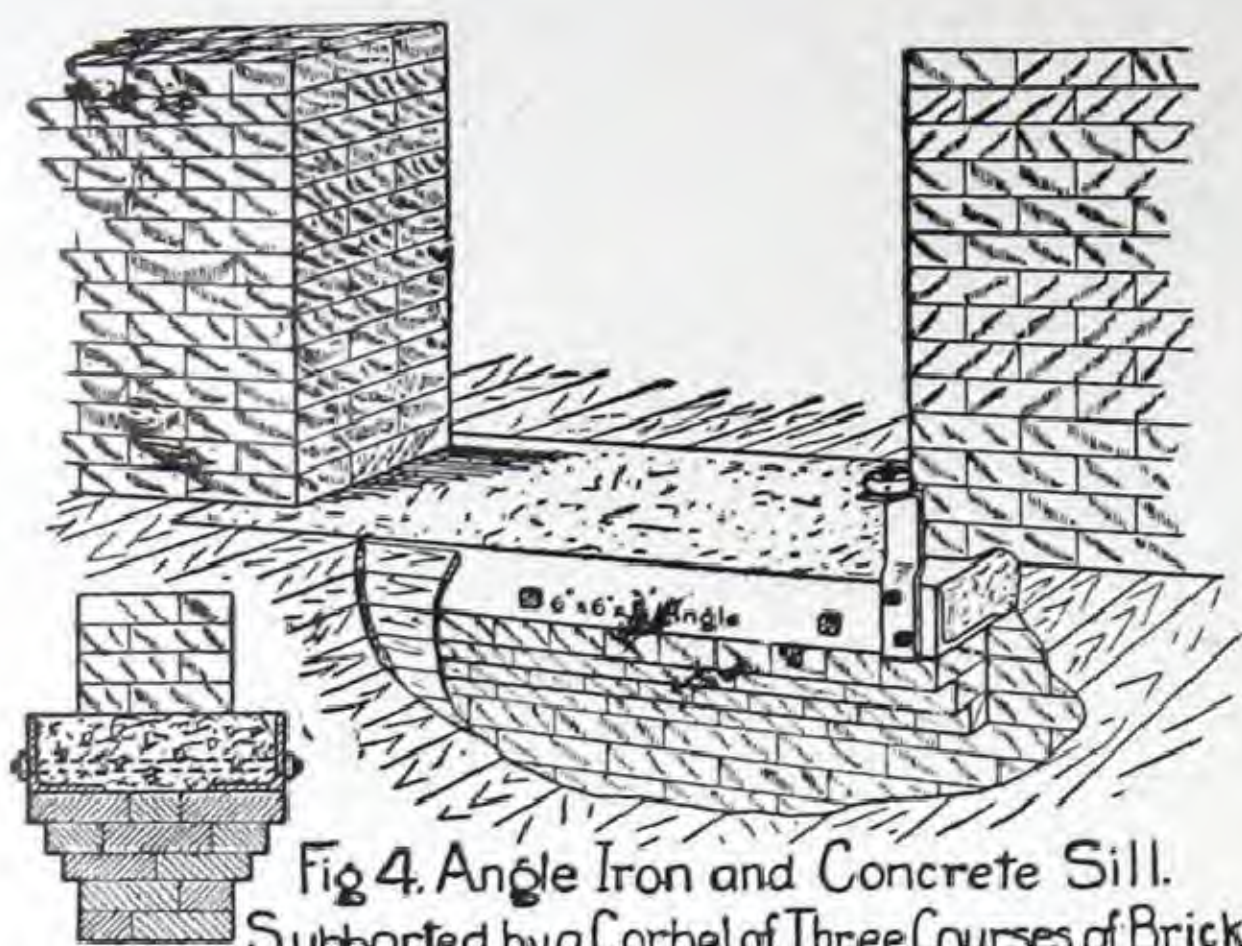


Fig. 4. Angle Iron and Concrete Sill.
Supported by a Corbel of Three Courses of Brick.

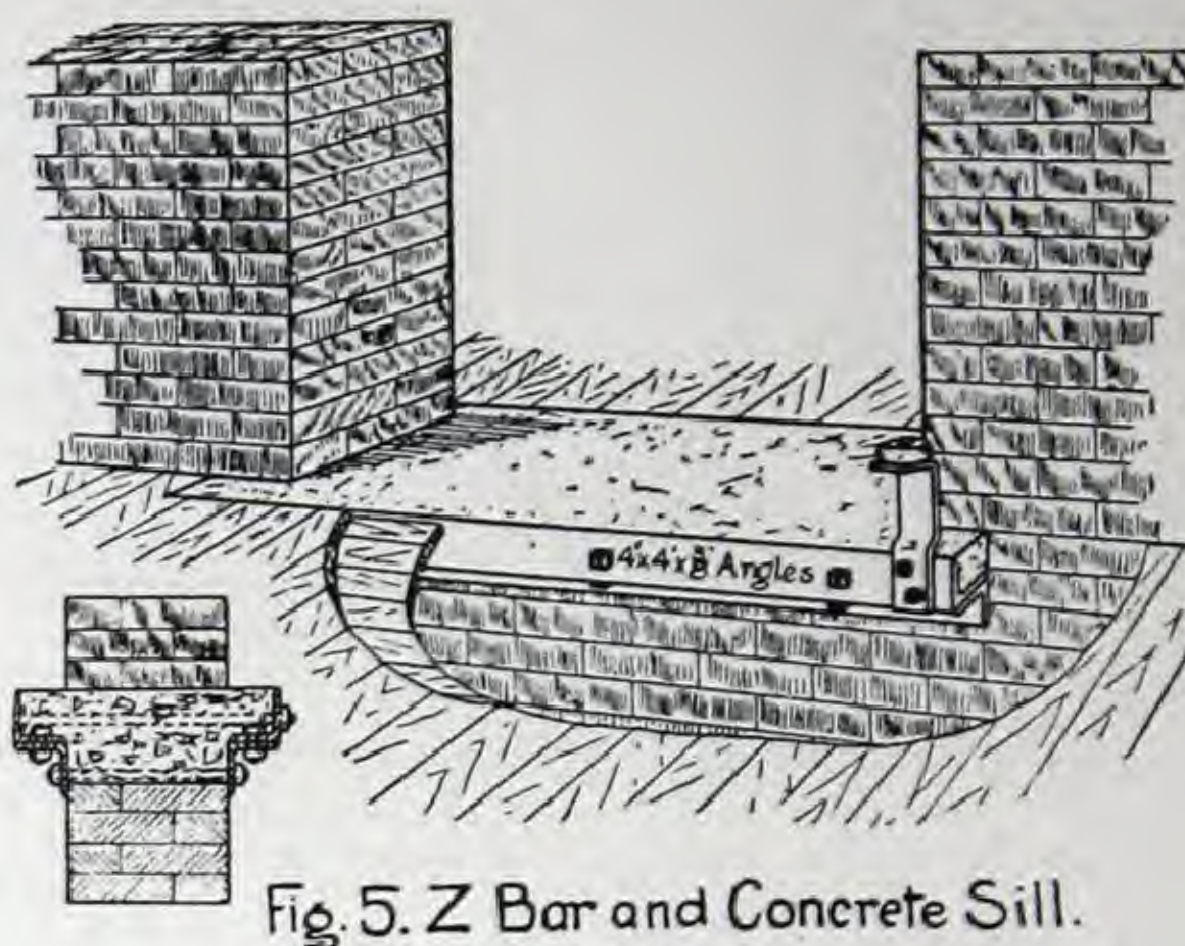


Fig. 5. Z Bar and Concrete Sill.

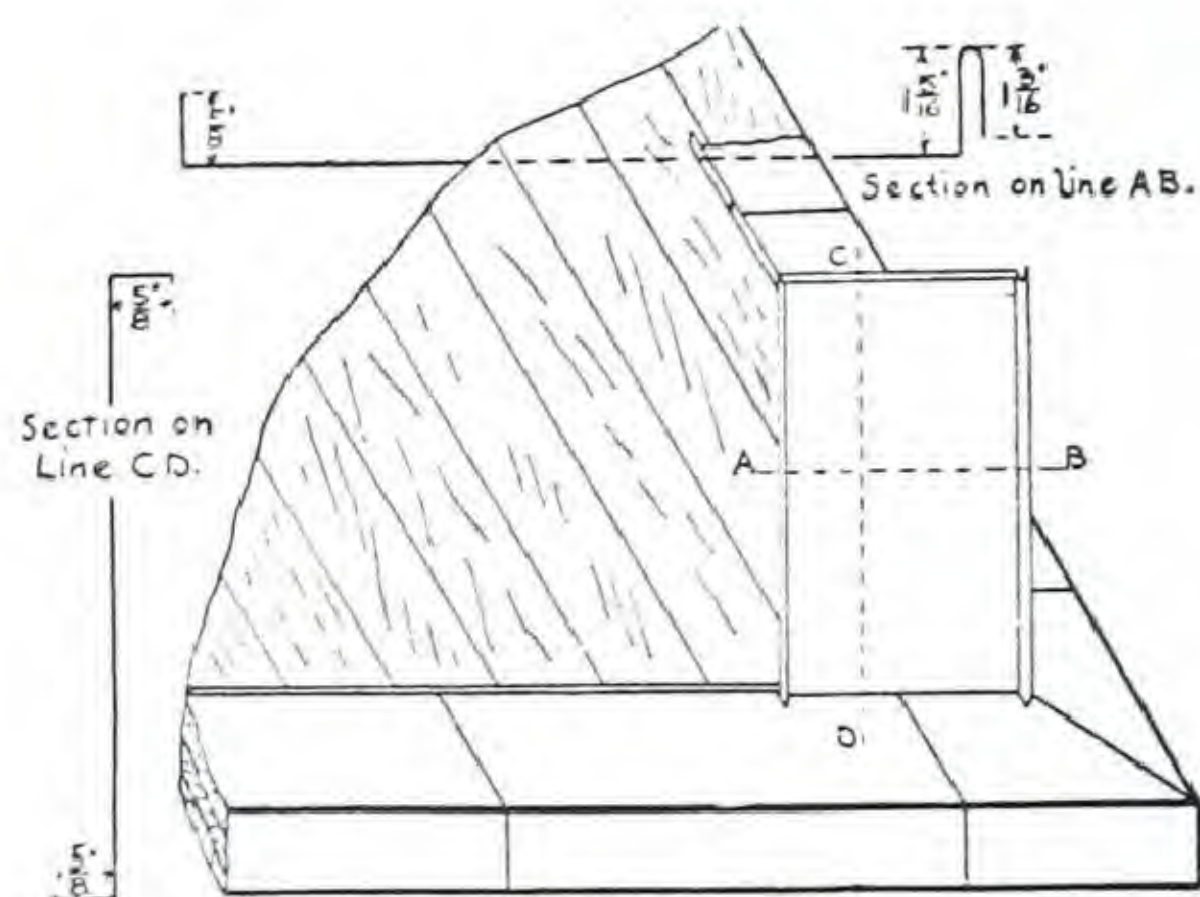


Fig. 24. First Position in Applying Side Sheets Showing Method of Bending.

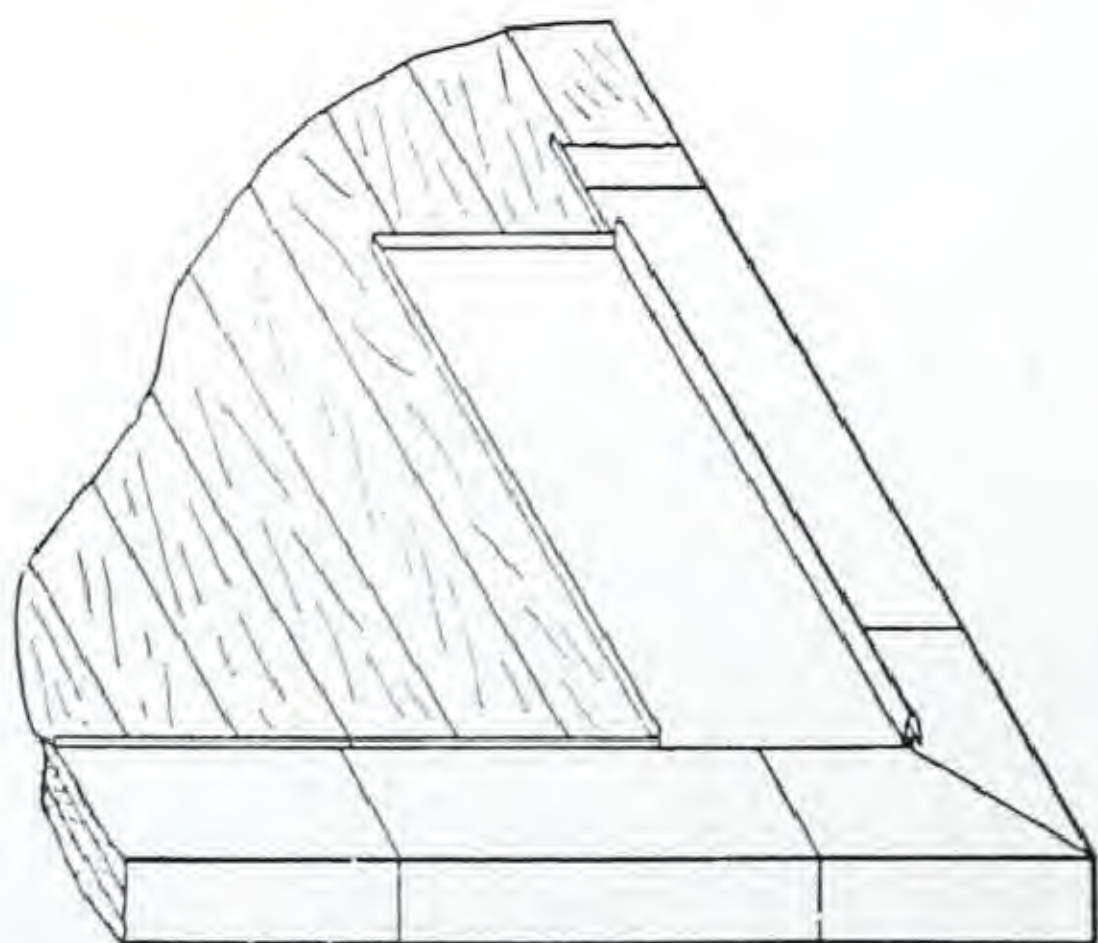


Fig. 25. First Sheet in Position Showing Lower Horizontal Seam Finished.

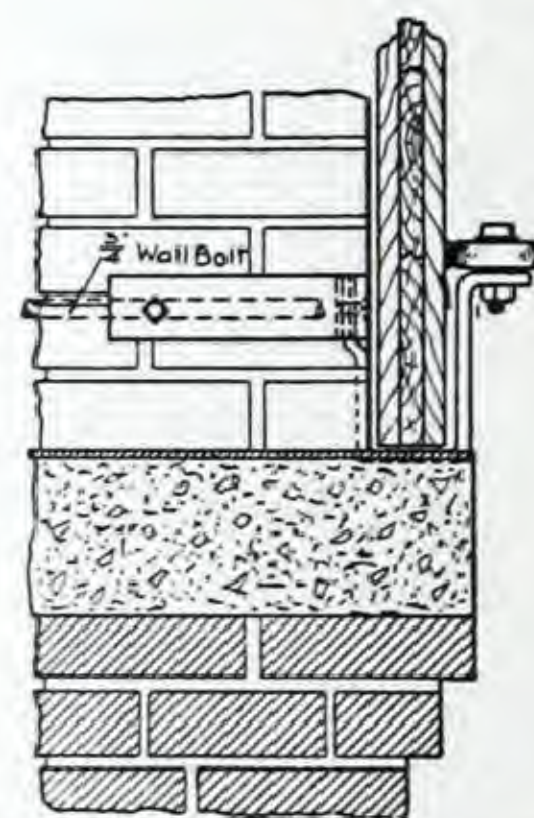


Fig. 29. U Shaped Stay Roll.
Used with Old and Concrete
and Steel Plate Sills.

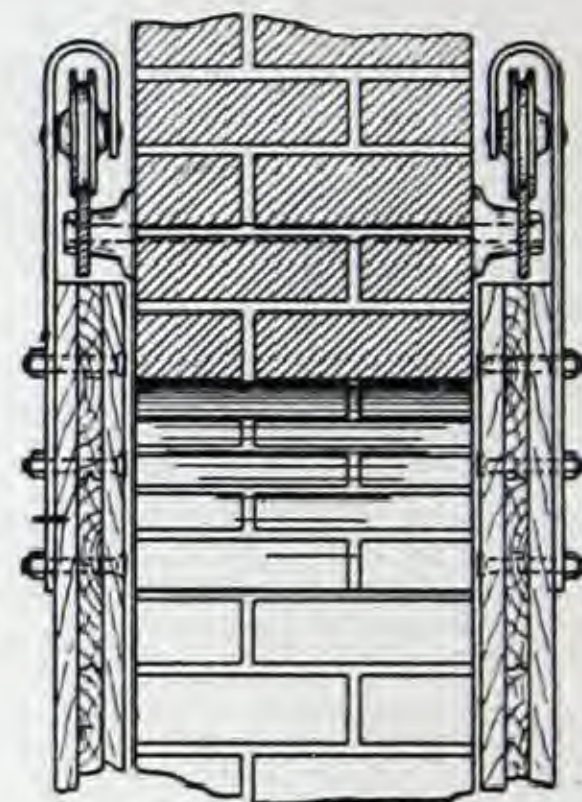


Fig. 28. Opening Protected by
Standard Double Sliding Doors
Mounted with Standard Hardware.

ALLITH MFG. COMPANY, LIMITED

HAMILTON - ONT.

Products We are manufacturers of the "Reliable" approved Fire Door Fixtures and Parlor Door Hangers, Barn Door Hangers, Freight Shed Parallel Door Equipment, Store Ladders, Merchandise Carriers.



New Garage Flush Hanger

Description Door is made same size as opening. Opening is made with a jamb same as any hinged door. The sliding door when opposite opening hinges into same. This hanger combines the advantages of a track and hinged door and is adjustable as well.

Track Covered Track, 13 gauge, self cleaning, 3 feet sections.

Fire Door Fixtures

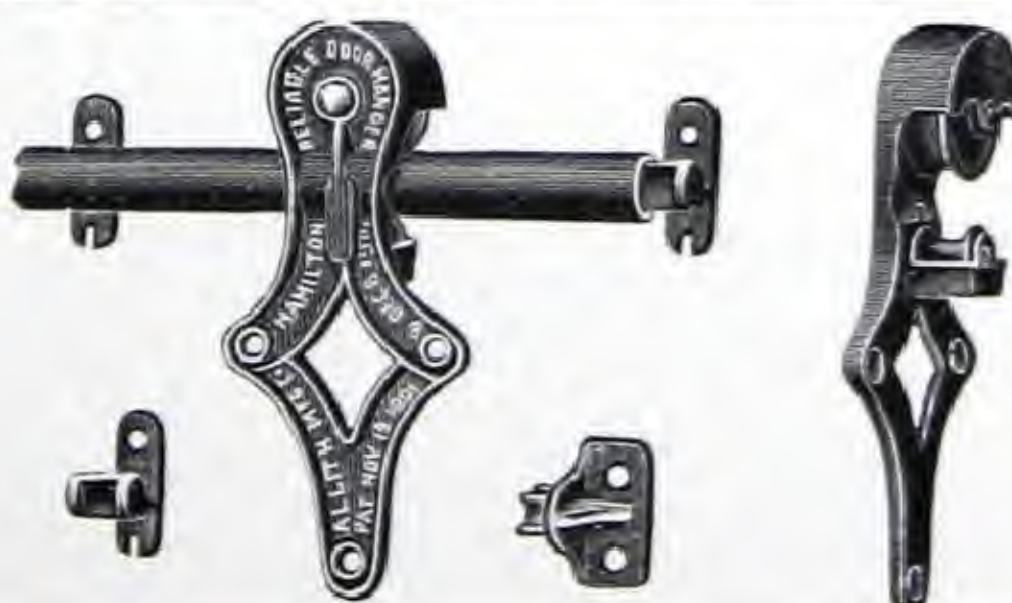
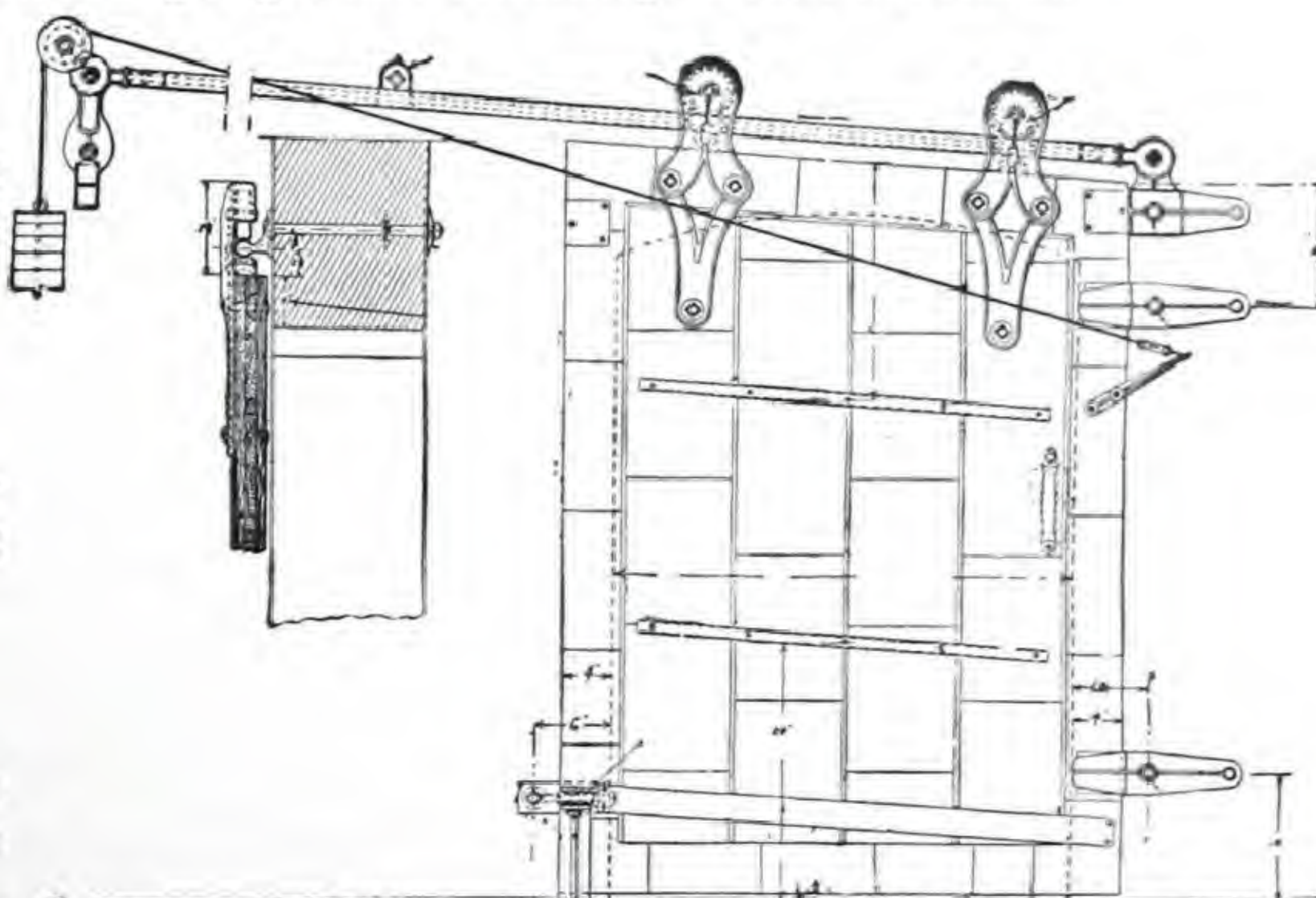
Our fire door fixtures are labelled by the Fire Underwriters.

Types

We make all types including sliding, swing and vertical.

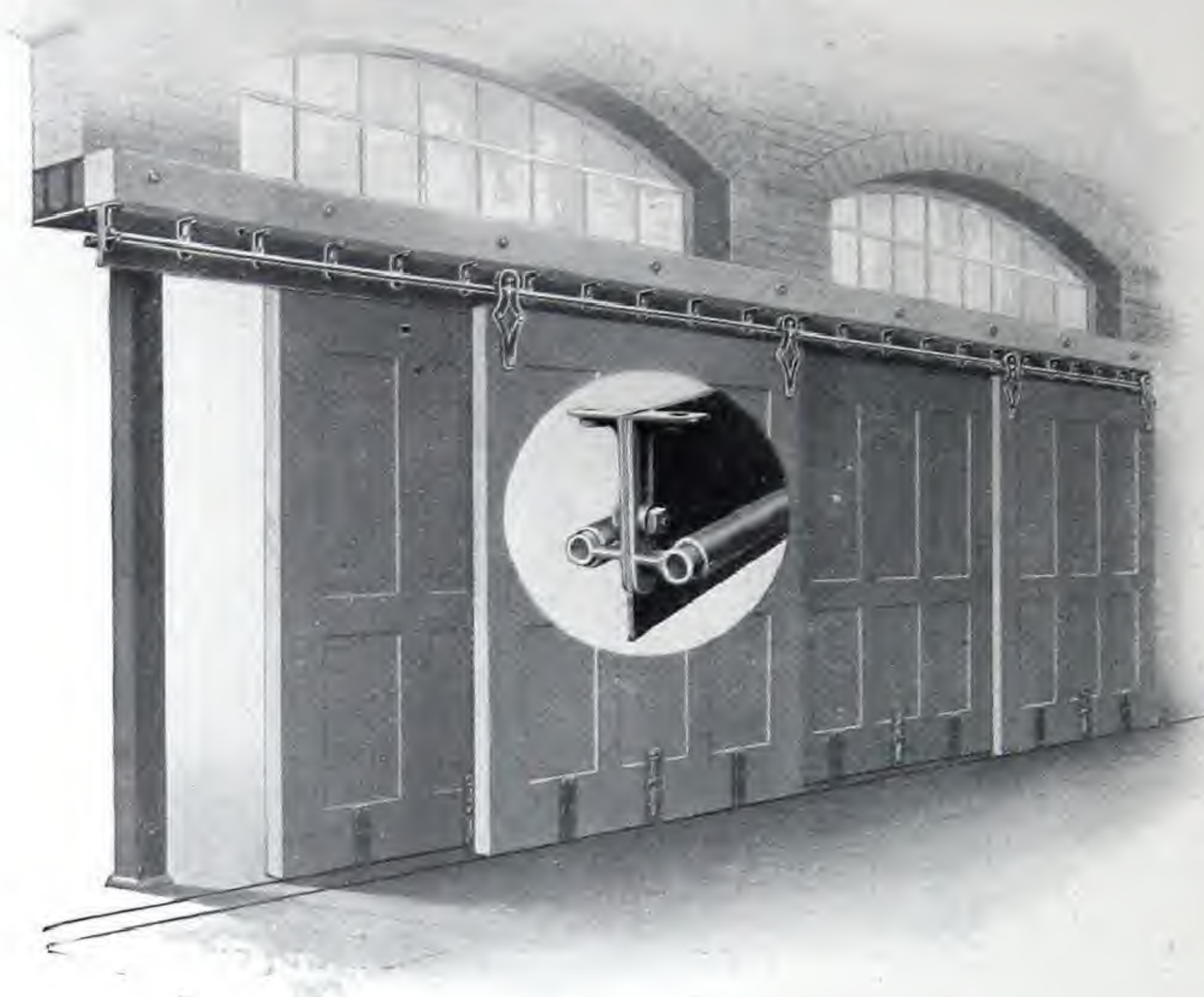
Reliable Hanger

Doors hung with "Reliable" Hangers and Track (with adjustable support) is acknowledged the easiest running combination on the market. The Reliable Track is different from the old style track with rivetted supports.



Continued on next page

ALLITH MANUFACTURING COMPANY, LIMITED



Allith Parallel Door Equipment

This equipment is designed to insure perfect movement of continuous parallel doors such as freight sheds, warehouses, etc., Nos. 2, 3, 5, 6, Hangers can be used according to the different weights, thicknesses of doors, etc.

The Stormproof Plate. Extending from overhead beam to below top of doors and the track supports are fitted and bolted together in convenient sections before leaving factory making it the strongest and most simply installed parallel equipment on the market. The distance required between top of the door and the bottom of the beam or overhead structure supporting the track is as follows:

No. 2.	Hanger with No. 12 Track (storm plate is 7 in. wide).....	6½ in.
No. 3 and 5.	Hangers with No. 13 Track (storm plate is 9½ in. wide)....	8½ in.
No. 6.	Hanger with No. 16 Track (storm plate is 10½ ins. wide).....	10 in.

DIMENSIONS

		Diam. Upper Wheel	Size of Track
No. 2.	Hanger—Frame 6 in. wide, 12 in. long.....	2½ in.	14 ga. 1 5/16
No. 3 & 5.	Hanger—Frame 8 in. wide, 21 in. long.....	4 in.	10 ga. 1 7/16
No. 6.	Hanger—Frame 8 in. wide, 22½ in. long.....	4 in.	10 ga. 1 7/16
Nos. 2 and 3 Hangers are non-adjustable.			
No. 5 Hanger has a vertical adjustment of 1¼ inch.			
No. 6 Hanger has a vertical adjustment of 1 in. and lateral adjustment of 2½ inches.			

Corres- Write for detail drawings, booklets or any other information
pondence which will be gladly forwarded on request.

THE TRUSSED CONCRETE STEEL CO. OF CANADA, LTD.

Head Office and Factory
WALKERVILLE, ONT.

Sales Offices and Show Rooms:

23 Jordan St. - Toronto

MONTREAL, 128 Coristine Building

HALIFAX, Chronicle Building

WINNIPEG, 803 Union Bank Building

VANCOUVER, 52 Hutchison Building

Products Kahn System Sash for use in Factories, Warehouses, Power Houses, etc. Made of Specially Rolled Mild Steel Sections.

Special Fire Proof—Weather Proof—Permanent.

Features Specify the following features:

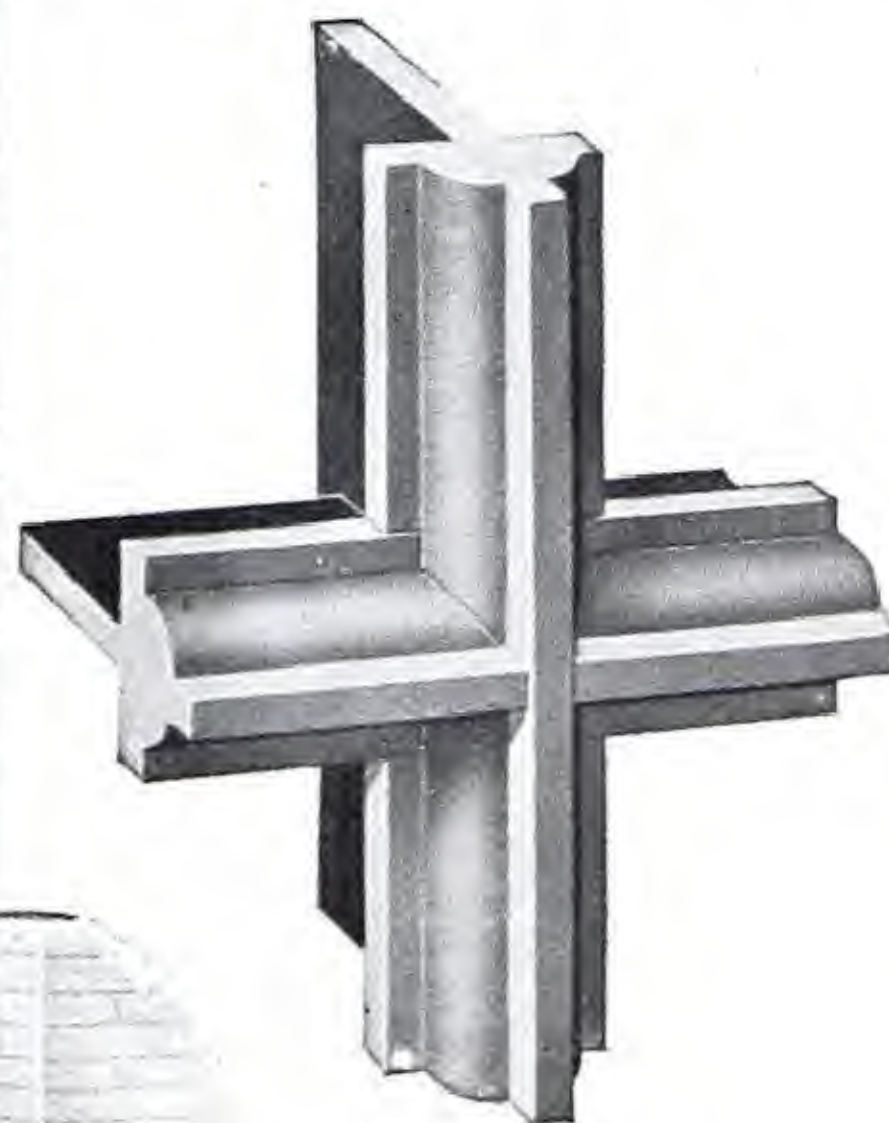
Section 105 as on outside frame section. Note the manner in which this section provides a wind-break, covers the mortar joint and provides a building line for the masons on both sides of the mortar joint.

A two-point contact ventilator.

Four Clips to each pane of glass to ensure that the glass will not be blown out; and also specify Kahn System Sash Putty, self-hardening and specially prepared for metal sash.

Ventilators hinged on Kahn's Patent Hinges. These hinges are an integral part of the sash and cannot be put out of order.

See also our advertisement—"Reinforced Concrete."



Kahn Sash
Joint

Typical Power House Sash

DOUGLAS BROS., LIMITED

Factories at

124 Adelaide St. W.
Toronto, Ont.

19 St. Maurice St.
Montreal, Que.

Products We are highly equipped in the Sheet Metal Department and Manufacture a full line of Sheet Metal Ornamental Work and execute all kinds of metal Roofing in Galvanized Iron, Tin and Copper, also Skylights, Cornices, and Enrichments, Pediments, Ventilators, Corrugated Iron, etc.
We also make a speciality of Duct work for heating and ventilating systems.

Roofing We are prepared to undertake contracts in any part of Canada for Slate and Tile Roofing of any design, Gravel or Slag Roofing, laid according to specifications or specifications supplied by us.

Skylights We make patent Metal Skylights in Galvanized Iron, or Copper, with or without reinforced stiffing Bars, according to length of the Bar. Our Skylights are arranged with Condensation Gutters as will be seen in illustration and are perfectly water and wind proof.



Estimates We invite Architects to submit their detailed drawings and specifications to us and we will be pleased to submit estimates thereon.

Catalogues or further information sent on request.

Continued on next page

DOUGLAS BROS., LIMITED

Factories at

19 St. Maurice St.
Montreal, Que.

124 Adelaide St. W.
Toronto, Ont.

Products Fire-proof Standard Doors, Kalamein Doors, Hollow Metal Windows, Kalamein Windows, Fire-proof Partition.

Under-writers Inspection Our Products are made in accordance with the rules and requirements of the National Board of Fire Underwriters.

Construction All wood work used in the construction of our Metal Covered Doors is thoroughly seasoned white pine. The doors may be covered with either Cold-Rolled Copper, Bronze or Kalameined Steel.

Estimates Send plans and specifications at our expense. We will be pleased to furnish estimates at request in either supplying or erecting in any part of Canada.

Correspondence Write for our Catalogues giving further detail information about doors and windows.

Facilities Our plant is equipped with the most modern machinery enabling us to turn out all work with speed and first class workmanship.



Copper Covered Doors installed in
The Bell Telephone Office Building
Toronto, Ont.



Kalamein Covered Elevator Front
R. S. Williams Building,
Toronto, Ont.

JAMES G. WILSON MFG. COMPANY

332 South Michigan Ave.
CHICAGO

3 West 29th St.
NEW YORK

Factory:
NORFOLK, VA.

Products Steel, or Wood Rolling Door and Shutters.
"Salamander" Roller Shutters and Swing Sliding Doors.

Description We manufacture three styles of Rolling Steel Shutters. These styles are made in various gauges of steel according to the purposes required and size of openings to be covered. In operation some are simply pushed up and down, some are worked by a winch with gear or chain hoist and others with heavy gear and electric motor.



Northern Pacific Railroad Shed, Seattle, Wash.

Showing Wilson's Self Coiling Corrugated Rolling Doors. The bays are 20 feet wide, divided in centre by hinged pilasters.

Fire Doors Our Fire Doors are approved and labelled under supervision of Underwriters' Laboratories.

Wilson's Rolling Wood Doors and Partitions Have the slats held together in close contact all the time, and proper provision is made for their swelling or shrinking from atmospheric conditions. This action is automatic and perfect. A Rolling wood door constructed in any other way will prove unsatisfactory.

Information Our Engineers' Handbook and our standard detail sheets on rolling doors and shutters mailed free on request

ROOFING NOTES AND SPECIFICATIONS

GENERAL.

The contractor to assure himself that all roofs are constructed in accordance with plans and satisfactory for the successful laying of his work; also that all necessary sheathing is in place, all walls and chimneys above roof line complete, and all vent pipes in place, before starting his work. He is to furnish and place to suit his work all strips of required width under hip rolls, all cant strips used under tiles at the eaves, and supply his own scaffolding (unless otherwise provided for). The contractor to furnish and place on the roof all gutters (which on tile roofs, whether box, hanging or secret, to extend over the roof sheathing and cant strip, and run under the felt and tile at least eight inches). He is to place all valley metal, the width of which must not be less than inches, with both edges turned up one-fourth

inch the entire length of the valley. Valley metal to be held in place by (copper) clips, and no nails or any fastening which will puncture the metal will be allowed.

The valley metal must be laid over one layer of felt (specify weight) running lengthwise the entire length of the valley. The contractor is to provide and place all flashings used along sides and in front of dormers, gables, skylights, towers, chimneys or any place where same is necessary.

After the contractor is satisfied with the roof and sheathing he is to cover entire roof with (one thickness) of asphalt roofing felt weighing not less than 30 pounds per square. Felt to be laid with 2½ inch lap, secured in place by nails with caps. The felt should be laid parallel to the eaves and lapped over all valley metal about four inches and laid under all flashings about six inches.

NOTES ON SLATE.

Number and superficial area of slate required for one square of roof, allowing standard 3 inch lap. (1 square=100 square feet.)

SIZE. Inches.	Number per Square	Area in Sq. ft.	SIZE. Inches.	Number per Square	Area in Sq. ft.	SIZE. Inches.	Number per Square	Area in Sq. ft.
6x12	533	267	9x16	246	...	16x20	137	...
7x12	457	...	10x16	221	...	12x22	126	231
8x12	400	...	9x18	213	240	14x22	108	...
9x12	355	...	10x18	192	...	12x24	114	228
7x14	374	254	12x18	160	240	14x24	98	...
8x14	327	...	10x20	169	235	16x24	86	...
9x14	291	...	11x20	154	...	14x26	89	225
10x14	261	...	12x20	141	...	16x26	78	...
8x16	277	246	14x20	121	...	.....	...	...

As slate is usually laid, the number of square feet of roof covered by one slate can be obtained from the following formula :

$$\frac{\text{Width} \times (\text{length}-3 \text{ inches})}{288} = \text{the number of square feet of roof covered.}$$

Weight of slate of various lengths and thicknesses required for one square of roof : based on the number of slate required for one square of roof, taking the weight of a cubic foot of slate at 175 pounds.

Length in inches.	Weight in Pounds per Square for the Thickness.							
	⅛ Inch	⅜ Inch	¼ Inch	⅝ Inch	½ Inch	⅞ Inch	¾ Inch	1 Inch
12	283	724	967	1,450	1,936	2,419	2,902	3,872
14	260	688	920	1,379	1,842	2,301	2,760	3,683
16	445	667	890	1,336	1,784	2,229	2,670	3,567
18	434	650	969	1,303	1,740	2,174	2,607	3,480
20	425	637	851	1,276	1,704	2,129	2,553	3,408
22	418	626	836	1,254	1,675	2,093	2,508	3,350
24	412	617	825	1,238	1,653	2,066	2,478	3,306
26	407	610	815	1,222	1,631	2,039	2,445	3,263

TESTS TO ASCERTAIN THE QUALITY OF SLATE.

1. As a rule, good slate when struck gives a clear, bell-like sound.

2. It is generally considered a good sign when it shatters more or less before the edge of the axe.

3. Light blue slate is less absorbent, as a rule, than blue-black varieties.

4. Good slate has a hard rough feel, while an absorbent slate feels smooth and greasy.

5. The absorptive powers of slate may be tested in two ways:—

(1) Place the slate on edge, half immersed in water. If it draws up the water and becomes wet at the top in six or eight hours it is spongy and bad. The extent to which the water extends is roughly the measure of absorption.

(2) Weigh a piece of slate dry and then again after immersion in water for twelve hours, after wiping off the superficial water; if it shows much increase in weight, it is too absorptive to be good.

In good work the top courses of slates, and slates at valley, gutters and hips, are laid in elastic cement, and counter flashing is brought down and out onto the roof about 3 inches.

Where valleys finish close no valley metal is visible; this construction should not be used unless the pitch of the roof is over 45 degrees.

Slate should be hard and tough. If too soft, the nail holes become large and the slates get loose on the roof. If the slate is brittle it is likely to break in squaring and holing, or will get broken on the roof.

Nail holes are punched with a slater's axe or drilled and countersunk. When slates are laid on steel purlins they are fastened with copper wire or clinch nails.

Slate can be obtained in bluish black, dark blue, purple gray, green and red, in different shades of these colors, and in mottled mixtures.

SPECIFICATION CLAUSES FOR SLATE ROOFS.

After roofs have all valley metal, sheathing, felt, etc., laid, they are to be covered with (name variety of slate and size), with the standard 3 inch lap. Each slate to be held in place by 2 copper (or 3 dip galvanized wire) nails of suitable size.

Slate at the ridges, valleys, etc., to be cut so that the bond with other slates will be uniform. Each course to break joints with adjoining courses. Valleys to finish (open), and slates on one side of the ridge to project and finish without cresting.

SHINGLE ROOF SPECIFICATION.

The best shingles are those made from cypress, redwood or cedar, in the order mentioned. Redwood, while perhaps not quite as durable as cypress, is less inflammable; sawed pine shingles are inferior to cedar, and spruce shingles are not suitable for good work.

Cypress shingles are usually 18 inches long and 7/16 inch thick at the butt. Those from all other woods are 16 inches long and about 5-16 inch thick at the butt.

NUMBER OF SQUARE FEET 1,000 SHINGLES WILL COVER.

Laid.	Area Covered	No. to a Square
4 inch to the weather...	100 sq. ft.	1,000
4 1/4 inch to the weather...	110 sq. ft.	910
4 1/2 inch to the weather...	120 sq. ft.	833
5 inch to the weather...	133 sq. ft.	752
5 1/2 inch to the weather...	145 sq. ft.	690
6 inch to the weather...	157 sq. ft.	637

With a rise to the roof of 8 to 10 inches to the foot, cedar shingles should be laid 4 to 4 1/2 inches to the weather; with rise from 10 to 12 inches, 4 1/4 to 4 3/8 inches to the weather; and on steeper roofs they may be laid 4 1/2 to 5 inches. Redwood shingles may be laid 1/2 inch more to the weather.

A pitch of 1 to 3 may be taken as the minimum allowable for shingle roofs.

Specify how shingles are to be laid, i.e., length exposed to weather. If on tar felt, building paper or in mortar. Specify kind of stain and whether dipped or brushed on.

Number and weight of shingles required to cover one square of roof:—

Inches exposed to weather.....	4 4 1/2	5 5 1/2	6
Number of shingles per square of roof.....	900	800	720 655 600
Weight of shingles on one square, pounds...	216	192	173 157 144

The number of shingles per square is for common gable roofs. For hip roofs add five per cent. to these figures.

CEMENT TILE.

In mill buildings the roofing often consists of cement tile. In this connection the following data may aid in the preparation of the specification.

CEMENT.

Refer to specification for cement.

REINFORCING.

Reinforcing generally consists of expanded metal placed near the lower edge of the tile. There should be sufficient steel used to develop the full strength of the tile in bending.

STRENGTH.

It is the custom in cement products to specify the breaking or ultimate strength. A good cement tile, 30 days old, supported at its ends and uniformly loaded should begin to fail under about 200 pounds per square foot. When 3 months old the load may be about 250 or 300 pounds per square foot. No tile should be placed until it is at least 30 days old.

SIZE AND WEIGHTS.

A common mill tile has a weather exposure of 24 inches by 48 inches, and an over-all size of 26 inches by 52 inches, with an average thickness of about one inch. Weights should be obtained of the make of tile to be used. Roughly, tile of this description will weight 15 pounds per square foot of roof.

PURLINS.

The tile is laid directly on the purlins, whether steel or wood. These are spaced 4 feet centre to centre, but this measurement may vary from 3 feet 10 inches to 4 feet $\frac{1}{2}$ inch. Purlins should consist of single shapes, preferably channels or Z bars.

Trussed purlins should be avoided. Purlins should be straight and kept so by $\frac{5}{8}$ sag rods; one rod in bays up to 16 feet, and two rods in all bays over this. At the eaves the purlins should be raised one inch to give the proper cant to the lower tile course, by means of fillers held by purlin rivets. Also where short courses are used at the ridges the purlins should be raised. Short tile spacing should always be at top of roof. Ridge purlins should be so spaced from the centre line of the roof that there will be room for the ends of the tile and also to allow the ridge roll the necessary lap.

FASTENINGS.

Tile are held in place by locking over the purlins and by means of lugs and (copper) wire fastenings. The kind of fastening is determined by the tile maker.

CLAY TILE ROOFING.

There are so many patterns of roofing tile that it is impossible here to enter into a description of them. Of the various patterns, those which interlock are considered to make the most satisfactory roof from a practical standpoint.

Roofing tile may be laid on felt or sheathing, or those with a proper interlocking device may be laid direct on wood or steel purlins without sheathing or inner roof of any kind. Most tiles, however, are nailed to the sheathing.

Clay roofing tiles weigh from 750 to 1,200 pounds per square (100 square feet).

SPECIFICATION CLAUSES FOR TILE ROOFS.

The tiles should be hard burned, of color, free from all cracks, chips, crazing and generally equal to the sample submitted to the architect. All pieces twisted or warped in burning, and which cannot be set straight or in line should not be used. No attempt shall be made to stretch the courses.

Tile are to be fastened and held in place with copper (or 3-dip galvanized steel nails), one nail to each tile. The tile must be laid so that the vertical lines up and down the roof are parallel, and make an angle of 90 degrees with the eaves.

Tiles along the hips should be cut close against the hip boards, and a watertight joint made by cementing cut tile to hip board with elastic cement. Each tile of the hip roll shall then be nailed to the hip board and the joints cemented, where they lap, with elastic cement. The interior spaces of hip and ridge rolls must not be filled with the pointing material.

CORRUGATED IRON ROOFING.

For covering roofs, either 3, $2\frac{1}{2}$ or 2 inch corrugations should be used, the 2 inch being the most common size. The thickness or gauge will depend on the distance between the supports on which the sheets are laid.

Nos. 26 to 28 gauges should be laid on close sheathing, or strips not more than 1 to 2 feet between centres. The maximum distances between supports for other gauges should be as follows:—

For No. 24 gauge, 2 to $2\frac{1}{2}$ feet from centre to centre.

For Nos. 22 and 20 gauge, 2 to 3 feet from centre to centre.

For No. 18 gauge, 4 to 5 feet from centre to centre.

For No. 16 gauge, 5 to 6 feet from centre to centre.

The least pitch which should be given to roofs that are to be covered with corrugated sheets is 3 inches to the foot, and for truss roofs it is not desirable to have less than a one-fourth pitch (6 inches to the foot).

When laid on a roof, corrugated sheets should have a lap at the lower end of from 3 to 6 inches, according to the pitch of the roof. For a $\frac{1}{2}$ pitch, a 3 inch lap; for a $\frac{1}{4}$ pitch, a 4 inch lap, and for a $\frac{1}{8}$ pitch, a 5 inch lap.

Ordinary corrugated sheets should have $1\frac{1}{2}$ or 2 corrugations side lap for roofing in order to secure watertight side seams; if the roof is rather steep $1\frac{1}{2}$ corrugations will answer. Some manufacturers make a special high edge corrugation on sides of sheets, and thereby are enabled to secure a waterproof side lap with one corrugation only, thus saving from 6 to 12 per cent. of material to cover a given area.

In applying to sheathing or wood strips, the sheets are secured by nailing through the tops of the corrugations, the nails being driven through every alternate corrugation at the ends, and about 8 inches apart at the sides.

When applied to iron or steel purlins, the side laps should be at least $1\frac{1}{2}$ corrugations, and the sheets should be riveted together every 8 inches on the sides and at every alternate corrugation at the ends. To fasten the sheets to the purlins, which are usually of angles, a cleat of band iron $\frac{3}{4}$ or $\frac{7}{8}$ of an inch wide may be passed around or under the purlins and riveted at both ends to the sheet. By contracting or pressing this cleat toward the web, a tight, secure fastening is made, which allows for contraction and expansion of the sheets.

Cleats, however, are generally used only with channel or Z-bar purlins. For angle-iron purlins, the clinch nail (of soft iron wire) is most commonly used; it makes a very satisfactory fastening.

The following table shows the size of clinch nails to be used with different sizes of angle purlins, and also the number of nails to the pound in each instance.

Purlin Angle	2x2 in.	2½x3 in.	3½x3½ in.	4x4½ in.
Length of Nail	4 in.	5 in.	6 in.	7 in.
No. of Nails per lb.	48	38	33	27

In ordering corrugated sheets an allowance must be made in the laps. The following table gives the number of square feet necessary to cover one square of actual surface, using sheets 8 feet long. If shorter sheets are used, the allowance must be slightly increased:—

NO. OF SQUARE FEET OF CORRUGATED SHEETS TO COVER 100 SQ. FT. OF ROOF.

End laps.....	1 in.	2 in.	3 in.	4 in.	5 in.	5½ in.
	Feet	Feet	Feet	Feet	Feet	Feet
Side lap, 1 corrugation.	110	111	112	113	114	115
“ “ 1½ corrugations	116	117	118	119	120	121
“ “ 2 corrugations	123	124	125	126	127	128

Weights of corrugated iron or steel plates per 100 sq. ft., in pounds.

Galvanizing sheet iron adds about 2½ ounces to its weight per sq. ft. Standard lengths, 5, 6, 7, 8, 9 and 10 ft.; maximum length, 12 ft.

Corrugations	⅝ Inch		1¼ x ⅜ Inches		2 x ½ Inches		2½ x ½ Inches		3 x ¾ Inches		5 x ⅞ Inches	
Gauge	Painted	Galvanized	Painted	Galvanized	Painted	Galvanized	Painted	Galvanized	Painted	Galvanized	Painted	Galvanized
28	72	87	72	87	68	85	68	85	68	85	68	85
27	79	94	79	94	76	91	76	91	76	91	76	91
26	86	101	86	101	83	98	83	98	83	98	83	98
25	100	115	100	115	96	111	96	111	96	111	96	111
24	114	129	114	129	110	124	110	124	110	124	110	124
23	...	...	128	143	123	138	123	138	123	138	123	138
22	...	...	142	157	136	151	136	151	136	151	136	151
21	...	...	156	171	150	165	150	165	150	165	150	165
20	...	...	170	185	163	178	163	178	163	178	163	178
18	...	...	...	...	217	232	217	232	217	232	217	232
16	...	...	...	...	271	286	271	286	271	286	271	286

TIN ROOFS.

The Sheets.—Roofing plates are made of soft steel or wrought iron (more commonly of the former) and covered with a mixture of lead and tin, and are designated as “terne plates,” in distinction from plates coated only with tin, and therefore called “bright tin.”

The best roofing plates always have the brand stamped on them. The only way of being sure of a good tin roof is to specify a brand of tin that has a reputation for quality and durability.

Sizes.—The common sizes of tin plates are 10 x 14 inches and multiples of that measure. The sizes more generally used are 14 x 20 inches and 20 x 28 inches. The larger size is the more economical to lay, and hence roofers prefer to use it, but for flat roofs the 14 x 20 size makes the better roof.

ANTI-CONDENSATION LINING.

Wherever corrugated steel is laid on purlins with no sheathing or paper underneath, if the building is heated, moisture will invariably collect on the under side, and if the air in the building is warm and humid, considerable dripping will result. To prevent this dripping it is necessary to protect the under side of the corrugated steel with paper or felt. This may be done by first stretching poultry netting over the purlins, from eaves to ridge, and wiring the strips together at the edges. Over this should be laid one thickness of asbestos paper and one or two layers of saturated felt. The corrugated steel may then be fastened to the purlins in the usual way. The side laps may then be secured by stove bolts, with 1 x ⅝ x 4 inch plate washers on the under side, to support the lining.

Thicknesses.—Terne plates are made in two thicknesses, viz., 1C, in which the iron body weighs about 50 pounds per 100 square feet, and 1X, in which it weighs 62½ pounds per 100 square feet. For roofing the 1C, or lighter weight, is to be preferred, because the seams will not suffer as much from contraction and expansion as with the thicker plates.

Weights.—The standard weight of 14 x 20 inch 1C terne plates is 107 pounds to 112 sheets (the number usually packed in one box), and of 14 x 20 inch 1X sheets, 135 pounds; 20 x 28 inch sheets should weigh just twice as much. The black sheets before coating should weigh, per 112 sheets, from 95 pounds to 100 pounds for 1C, 14 x 20 inches, and from 125 to 130 pounds for 1X, 14 x 20 inches.

The difference between the weight of the black sheets and of the finished sheets shows the weight of the tin. A heavily-coated tin should weigh from 115 to 120 pounds per 112 sheets for 1C, 14 x 20 inches, and from 145 to 150 pounds for 1X, 14 x 20 inches; 20 x 28 inch sheets should, of course, weigh twice as much.

Number of Sheets Required to a Square.—For flat-seam roofing a sheet of tin 14 x 20 inches with $\frac{1}{2}$ inch edges, measures when edged or folded 13 x 19 inches, or 247 square inches, consequently the number of sheets required to a square equals 14,400 divided by 247, or $58\frac{1}{2}$; 1,000 square feet requires 583 sheets. A box of 112 sheets 14 x 20 inches will cover approximately 192 square feet.

Sheets 20 x 28 inches measure, when edged or folded, 19 x 27 inches, or 513 square inches. To cover 1,000 square feet 10 squares) requires 288 sheets.

The standing seams and locks on a steep roof require $2\frac{3}{4}$ inches off the width, and $\frac{3}{4}$ inch off the length of the sheet. A sheet 20 x 28 inches, with the seams on the narrow edges, will cover 486 square inches, and with the seams on the long edges, 470 square inches. The former requires 297 sheets to 1,000 square feet, and the latter 307 sheets.

SPECIFICATION CLAUSES FOR TIN ROOFS.

All tin used on this building shall be brand. No substitute for this brand will be allowed. Use 1C thickness for the roof proper, decks, etc., and 1X thickness for valleys, gutters and spouts, as required by design. One coat of red lead, iron oxide, metallic brown or Venetian red paint, with pure linseed oil, shall be applied to the under side of the tin before laying.

For flat-seam roofing, edges of sheets to be turned one-half inch; all seams to be locked together and well soaked with solder. Sheets to be fastened to the sheathing boards by cleats spaced eight inches apart; cleats to be locked into the seams and fastened to the roof with two one-inch barbed wire nails; no nails to be driven through the sheets.

For standing-seam roofing, sheets to be put together in long lengths in the shop, cross seams to be locked together and well soaked with solder; sheets to be made up the narrow way in the rolls and fastened to the sheathing boards by cleats spaced one foot apart.

Valleys and gutters to be formed with flat seams well soldered; sheets to be laid the narrow way.

Flashings to be let into the joints of the brick or stone work and cemented. If counter flashings are used, the lower edge of the counter part shall be kept at least three inches above the roof.

Solder to be of the best grade, bearing the

manufacturer's name, and guaranteed one-half tin and one-half lead—new metals. Use rosin only as a flux.

Caution.—No unnecessary walking over the tin roof or using same for storage of materials shall be allowed. In walking on the tin care must be taken not to damage the paint or to break the coating of the tin. Rubber-soled shoes or overshoes should be worn by the men on the roof.

No deviation from these specifications shall be made unless authority is given in writing by the architect. Only a first-class roof will be accepted.

FELT ROOFING.

Before commencing the actual roofing, the contractor is to examine all sheathing and see that ends of boards are resting on joist or purlin, and securely nailed; that no openings, such as knot-holes, open joints, etc., which will affect the finished roof, have been left in the sheathing, and where found he is to have same made good by carpenter before proceeding. Remove all loose nails, chips and other rubbish, and have the roof clean before laying felt. See that all nailing strips for flashings are in place.

Galvanized iron (24 gauge) counter flashing to be set in place by mason contractor at least $1\frac{1}{2}$ inches in the wall.

Cover all roofs with one layer of sized sheathing paper weighing 6 pounds per square (one layer asbestos roofing felt), lapped about one inch and nailed where necessary to keep in place with $\frac{7}{8}$ inch barbed nails driven through flat tin discs.

On roof thus covered lay 6 plies of tarred roofing felt (weighing 14 pounds per 100 square feet). Three plies laid and well tarred, lapped 17 inches and nailed as above where necessary.

Over this lay 3 plies of felt (32 inches wide), nailed at intervals of 10 inches along upper edge, 15 inches exposed to weather and well tarred under each lap.

Cover finished roof with heavy coat of tar, and, while hot, spread on fine clean sand, lake shore gravel or suitable slag.

Specify where coal tar, pitch or asphalt is to be used in the above and brand or quality.

At walls, chimneys, etc., the roofing is to be turned up at least 2 inches. A flashing of 2 ply felt to be fitted, well mopped in and securely nailed to roof, same to extend from

to at least 5 inches on to roof. Over this lay a similar flashing in hot tar in such a way as to cover nails in base flashing on roof, and go well under metal counter flashing, and nail through both flashings to nailing strip.

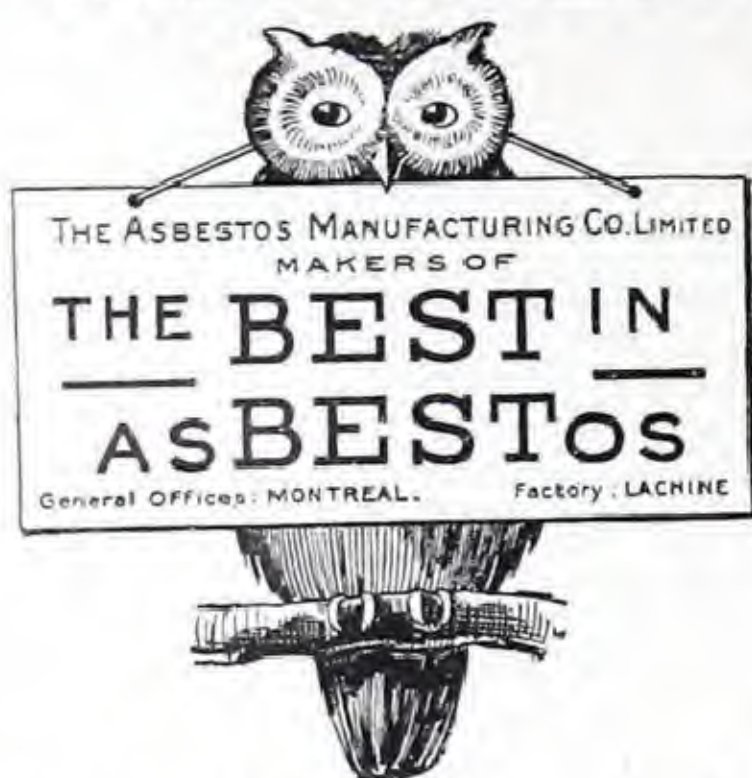
Metal counter flashing to be at least 5 inches up walls.

All flashing to be in place before roof receives final coat of tar.

Trussed Roofs and Roof Trusses, F. E. Kidder. Wm. T. Comstock & Company, New York.

Design Simple Roof Trusses in Wood and Steel, Prof. M. A. Howe. Jno. Wiley & Sons, New York.

THE ASBESTOS MANUFACTURING CO. LTD.



General Offices:

705 Eastern Townships Bank Building
263 ST. JAMES STREET - - MONTREAL

Factory at Lachine, Que.

Branch Offices:

Toronto - 601 C.P.R. Building
London - 55 Bank of Toronto Chambers
Winnipeg - 619 Somerset Block
Calgary - 401 Maclean Block

Maritime Provinces:

THE ASBESTOS & CEMENT PRODUCTS CO.

Quebec, P.Q. - St. John, N.B. - Halifax, N.S.

Products

We manufacture "Asbestoslate" Shingles, Asbestos Corrugated Roofing and Sheathing, Linabestos Wallboard, Asbestos Building Lumber, Asbestos Paper, Millboard, Sheet and Piston Packing, Air-Cell Paper and Pipe Coverings.

We also handle all products of the Keasbey & Mattison Company, Ambler, Pa., which are not made at Lachine, including 85 per cent. Magnesite Pipe Coverings and Cement, Asbestos Packings, Cloth, Theatre Curtains and all Asbestos Textiles.



Drill Hall, University Avenue, Toronto

Owners—Dominion of Canada

Roofing Contractors—J. Van Sickler & Co.

"Asbestoslate" Shingles

"Asbestoslate" Shingles may be applied either in the straight laid or American method, employing a shingle of a square or oblong shape which is laid exactly similar to natural slate or wood shingles. They can also be laid in the diagonal or French method using a 12" x 12" or 16" x 16" shingle. The Dominion Government has adopted the material for many of their larger buildings. The roof of the Armory shown in the above illustration is laid with 16" x 16" Gray "Asbestoslate" in accordance with the French or diagonal method. We advocate this style, type and size of shingle as being particularly suitable and eminently satisfactory.

Composition of "Asbestoslate"

Asbestos-cement shingles are composed of about 85 per cent. of the best Portland cement, combined with long fibre asbestos manufactured into thin sheets, the fibres of which form centres of crystallization for the cement and extending in every possible direction tie the great mass together with great strength. Enormous hydraulic pressure is then applied while the shingles are still wet, after which the setting is completed in the air. It is evident to one acquainted with Portland cement that this process will produce a product absolutely fire and waterproof and one that will increase in strength and firmness with the passing of time. See specifications, next page.

Continued on next page

Asbestos Corrugated	A thoroughly efficient roofing and sheathing, made in a single thickness and corrugated to add strength.
Size	Standard stock sheets 27½" x 4, 5, 6, 7, 8, 9, 10 foot lengths, 3/16" thick, 2½" corrugations.
Uses	For roofing and sheathing in a manner similar to corrugated iron, for iron foundries, chemical plants, gas houses, car shops, platform hoods. It has been found especially adaptable for gas houses and chemical plants where other materials fail on account of the fumes and gases. May be laid over a steel or wood framework, purlin spacing to be not greater than 36 inches.
Linabestos Wallboard	Flat sheets of Asbestos and cement combination similar to our Building Lumber but not as dense and decidedly cheaper.
Size	Standard stock sheets 42" x 48", 42" x 96", 3/16" thick.
Uses	For complete interior lining of residences, cottages or bungalows; is especially well adapted to beam ceiling work and can be used to advantage for wainscoting kitchens, bathrooms, hallways, and for rendering fireproof light, elevator or stair shafts. For interior use only. This product is sold through agents throughout the country.
Asbestos Building Lumber	Made in flat sheets, very hard and dense. Portland cement and asbestos fibre in standard stock sheets 42" x 48", 42" x 96", thickness 1/8" and increasing by 1/8" to 5/8".
Uses	For sheathing the exterior of residences to obtain the English half-timber effect, replacing wire lath and plaster; exterior and interior of garages; wainscoting bathrooms, kitchens, hallways; for ceiling of kitchen or dining-room with beam ceiling finish; lining elevator shafts, for laboratory hoods and extensively in the electrical industry.
Lachine Waterproof Paper	This is a superior quality of saturated waterproof paper, put up in rolls of 500 square feet, weighing about 35 pounds to the roll. It is very tough and especially recommended for use under our Shingles and Building Lumber.

ARCHITECTS' SPECIFICATIONS FOR ASBESTOS-CEMENT SHINGLES AND SHEATHING

Paper	Roof rafters should be covered with well-seasoned boards not more than 9 inches wide, edges laid tight together (ship lap or tongue and groove), well spiked to rafters.
American Method	Cover the roof boards with a good quality of paper (Lachine Waterproof Paper) tacked on with 4 inch side lap and 1 foot lap on all hips and valleys. Over the paper lay "Asbestoslate" Shingles manufactured by the Asbestos Manufacturing Company, Limited, Lachine, P.Q., as follows:—a cant or furring strip 3/16" thick and 1" wide (lath will do) to be nailed flush with the lower edge of roof-boards to give the Asbestos-Cement shingles the proper pitch. Then apply one course of the No. 16, 8" x 16" Newport Gray Asbestos-Cement shingles end to end, overhanging the eaves 1½ inches. Over this lay No. 16 Asbestos-Cement Shingles 7 inches to the weather, in a similar manner to wood shingles, bringing the butts to the eaves edge and being sure to break all joints perfectly. Proceed thus to completely cover the roof.
French or Diagonal method	Over the paper apply Asbestos-Cement shingles, Newport Gray as manufactured by the Asbestos Manufacturing Company, Limited, Lachine, P.Q., according to the French or diagonal method, as follows:—A cant or furring strip not less than 3/16" thick and 1" wide (a lath will do) to be nailed flush with the lower edge of the roof boards to give the Asbestos-Cement shingles the proper pitch; then apply one course of No. 16 Newport Gray Asbestos-Cement shingles end to end, overhanging the eaves 1½ inches, then apply starter No. 35 Newport Gray, bringing the lower edge even with the first course of No. 16. Break the joints perfectly. Balance of the roof to be covered with No. 3 Newport Gray Shingle, 16" x 16" laid diagonally and exposed 13" x 13" to the weather. Each shingle to be nailed with two 1¼ inch galvanized iron needle point nails, as indicated by the nail holes in the shingles. The lower tip to be fastened down with patented copper storm nail, all as shown in the catalogue of the manufacturer.
Hip and Ridge Roll	Hips and ridges to be covered with Asbestos-Cement hip and ridge roll, same to be properly flashed and fastened in place to hip and ridge pole of sufficient height, with regular copper fasteners as furnished by the manufacturer. All hips and ridges to be made water-tight previous to the application of the ridge roll.
Flashing	All hips, valleys, chimneys and against all vertical surfaces, except as otherwise specified, flash and counter-flash with each course of shingles, using—
Starting Courses	For the No. 8, 12"x12" shingles, starters No. 21 and No. 36 should be used. For the No. 3, 16"x16" shingles, starters No. 16 and No. 35 should be used.

"Asbestoslate" is now used by all the railroads in Canada, by the Dominion Government, and has been applied to many large, prominent churches, residences, factories, cottages and bungalows throughout the country. It has distinctly proven its merit.

Manufacturers:
JOHN LYSAGHT, Limited
Bristol, England.

Managers, Canadian Branch:
A. C. LESLIE & CO., Limited
Montreal, Que.

“QUEEN’S



HEAD”

GALVANIZED IRON

The object of using a galvanized rather than an uncoated sheet of steel being to secure the greatest protection against rust, the most perfectly galvanized sheet should naturally be specified.

“Queen’s Head” brand is galvanized by a different process from other makes, and an experience of fifty years has proved it to be the most durable. It is a mistake to specify “Queen’s Head” or Equal—which allows the substitution of less durable sheets giving the contractor a larger profit.

How to Specify

All Galvanized Iron work to be of “Queen’s Head.” Brand to appear on every sheet.

Cornices—To be made of 28G “Queen’s Head” Galvanized Iron.

Conductors—All Conductors to be either Corrugated or made with expansion joints.

Flashings—To be of “Queen’s Head” Galvanized Iron.

Gutters—To be made of 26G “Queen’s Head” Galvanized Iron. All Gutters to be set with an even continuous fall to rain conductors.

Skylights—To be made of 24G “Queen’s Head” Galvanized Iron.

Ventilators—Skylights to have condensation gutters with discharge at eaves.

Weights Per Square Foot

Weight—	.671 lbs.	.75 lbs.	1.055 lbs.	1.24 lbs.	1.61 lbs.	1.95 lbs.	2.62 lbs.
Gauge—	28	26	24	22	20	18	16

Lysaght’s Sheets are rolled as true to gauge as possible, not varying more than 5% from these average figures. This is important, as light weight sheets are often supplied.

“Fleur-de-Lis”

Is made of the same quality of steel as “Queen’s Head” and is fully guaranteed for all working purposes. The chief difference is in the galvanizing which is slightly lighter than that on “Queen’s Head,” but it is fully equal to any other brand.

Corrugated Sheets

“Redcliffe” is the standard brand for this purpose, made of soft steel, uniform in weight, and of exactly the same finish as “Fleur-de-Lis.” For special work requiring the most durable galvanizing, “Orb” Brand should be specified.

LATHING, PLASTER AND STUCCO

WOODEN LATH.

Lath should be well seasoned, free from sap and loose knots. Bark on lath will stain the plaster. White pine is usually considered as the best wood for laths. Spruce and hemlock is used. Hard pine or Georgie pine contains too much pitch. Lath should be nailed solid, giving the proper space between; they should be spaced about $\frac{3}{8}$ inches apart for ordinary lime mortar and about $\frac{1}{4}$ inch apart when any of the hard or patent plasters are used. The laths should have one nail to every bearing and have two nails to each end. The perpendicular joints in the laths should be broken about every sixth lath. No laths should be set vertical to fill out any corner or any other place. Where laths cross a bearing over two inches wide a lath or strip should be put under the laths so the plaster will have a chance to key.

Laths over door or other openings should have as few vertical joints as possible, so as to prevent cracks; if possible the laths should extend across the opening.

1,000 laths $1\frac{3}{8}$ inches wide will cover about 570 square feet.

1,000 laths $1\frac{1}{2}$ inches wide will cover about 620 square feet.

1,000 laths require about 5 pounds of lath nails, 6 nails to a lath.

METAL OR WIRE LATHING.

Where metal or wire lathing is used it must be stretched tight and securely fastened. If it is put on wooden joists or studs it should be fastened with staples, and if fastened to metal furring or beams should be fastened with galvanized or coated wire. All metal lathing should be coated to prevent rust; it is usually prepared in this way by the manufacturers. In all angles where wood or terra-cotta partitions join the main wall of the building there should be a strip of the metal lath bent in the angle and extending out on each side about six inches and securely fastened; this will prevent any cracks in the angles after the plastering is done.

CORNER BEADS.

Metal corner beads should be used on all external angles, and care must be taken in setting them to get them straight and fastened solid.

PLASTERING

PLASTERING DATA.

1 barrel of lime will make about $2\frac{3}{4}$ barrels of paste.

1 bushel of hair weighs about 15 pounds.

1 barrel of lime, 18 cubic feet of sand, and 22 pounds of hair will brown coat about 40 yards on wooden lath with $\frac{7}{8}$ inch grounds, or about 32 yards on brick or terra cotta walls with $\frac{5}{8}$ inch grounds, or about 30 yards on wire or metal lath.

1 barrel of lime, 1 barrel of Plaster of Paris, 1 barrel white sand, will skim coat about 140 square yards.

First coat mortar = 1 barrel lime, 18 cubic feet sand, $1\frac{1}{2}$ bushels hair.

Second coat mortar = 1 barrel lime, $21\frac{1}{2}$ cubic feet sand, $\frac{3}{4}$ bushel hair.

Lime for making mortar for plastering should be of the very best quality and free from all dirt. It should slake readily, so there will be no unslaked particles of lime in the mortar to slake after it is put on the wall. If this happens the small pieces of lime swelling and slaking will cause small pieces of the plaster to fall off, leaving "pits" or holes. The lime should be slaked at least a week before being put on the wall.

SAND.

The sand should be sharp and angular, free from any dirt or oil or anything to stain the plaster.

HAIR AND FIBRE.

These are used in the mortar to form a bond and bind the sheet of mortar together. Cattle hair is generally used, but of late years jute and several fibre products have been used satisfactorily to a great extent.

MORTAR.

Mortar should be made up at least a week before it will be required for use. Ordinarily the hair is mixed with the mortar when it is made up, but on first-class work it should be added when the mortar is mixed for use.

If the hair is added to the mortar when the lime is first slaked there is danger of the hot lime burning the hair and causing it to rot.

Before the mortar is put on the contractor should examine all grounds to see that they are straight and solid, also see that all gas and electric outlets are in their proper places, and that every possible provision has been made for securing the wood or other finish in place. All walls should be dusted off and wet before any mortar is put on. The architect should see that the plasterers use sufficient force in spreading the first coat of mortar to force it through the lathing and key in all spaces. The space back of all wainscot or base should be plastered flush with the face of the grounds, so the wood will lay solid against the plaster.

Cornices or any ornamental work should be run and put in place before the finish or putty coat of plaster.

PATENT PLASTERS.

There are a number of hard or patent plasters on the market and sold under various names. The composition of these various plasters is pretty much the same, the hardness being based on the plaster of Paris or gypsum used in their manufacture. These plasters give good satisfaction and make a hard, durable job of plastering. For quick work or for use in cold weather, they are preferable to lime plaster, as they will set and harden much quicker.

When any of the hard finishes are used the plasterer will generally try to work lime putty in along with it to make it work smoother and easier. This may be permitted to the extent of about 15 per cent. lime by volume.

The covering capacity of the different patent plasters varies from 90 to 150 yards per ton of plaster.

SCAGLIOLA.

This is a composition made to imitate marble. It is composed of plaster of Paris or Keen's cement mixed with glue or gelatine, and the various colors are added to obtain the desired imitation. This work when properly done will take a good polish and makes a good imitation of marble.

CORNICES AND MOULDINGS.

Cornices, mouldings, etc., are usually run with a mould made of sheet iron and cut the reverse contour of the mouldings to be run. Strips of wood are nailed around the walls and ceiling to form a guide to run the mould along. These moulds are usually made to set at right angles to the mouldings, thus leaving a space the width of the moulding or cornice at all angles which have to be worked out by hand. If the mould is made to set at an angle of 45 degrees, or a true mitre with the moulding and the mould made to correspond with the profile of the mouldings on this angle, then the mould can be run in close to all angles.

KEENE'S CEMENT.

This cement, or plaster, is made by recalcining Plaster of Paris after soaking it in a solu-

LATHING, PLASTER, STUCCO—Continued

tion of alum; it is used for wainscot, base, caps, etc., and also for hard finish.

The first coat is composed of 1 part cement, 1 part lime paste, and 3 parts sand.

The second coat of 1 part cement, 1 part lime paste, and 4 parts sand.

1 ton of Keene's cement will first coat about 475 yards, or brown coat and white hard finish about 300 yards, or first and second coat about 350 yards.

LAFARGE CEMENT.

Lafarge cement is much used for outside stucco work. It should be mixed as follows:

First coat, 1 part cement, 3 parts sand, 25 per cent. lime paste, and sufficient hair.

Second coat, 1 part cement, 2 parts sand, 10 per cent. lime paste. 1 barrel of cement and 3 of sand will cover about 34 square yards $\frac{3}{8}$ inch thick.

1 barrel of cement and 2 of sand will cover about 25 square yards $\frac{3}{8}$ inch thick.

COMPO.

The term Compo has for years been used to describe a kind of plaster composition, used for architectural ornamental work, differing from other products, such as Papier-Mache, Carton-Pere, Staff, etc., which is most successfully employed when used on wood-work, although it may be applied to plaster walls and ceilings when these have been covered with cotton so as to guard against the probability of shrinkage separating the pieces from the plaster and allowing the ornament to fall.

IMITATION OF WOOD CARVING.

Models of wood carvings can be made showing the grain by indentation, corresponding exactly with the wood model from which it is produced. It resembles the best wood carving and will admit of being stained to match the article with which it is used.

As a carved wood model is the first requisite there is no economy in executing special designs unless a sufficient repetition to cover the first cost is required. Limit of size must be considered, as capitals over 15 inches diameter and heavy relief ornaments cannot be so successfully made in this material as smaller sizes, where sharp detail and the grain of wood is essential.

SPECIFICATION CLAUSES FOR LATH AND PLASTERING

LATHING.

All walls, partitions, and ceilings, and all furring, studding, under sides of stairs, etc., are to be lathed with best quality pine (spruce) laths, free from sap, bark or dead knots, and of full thickness. They are to be laid $\frac{3}{8}$ of an inch apart on the ceilings and $\frac{1}{4}$ of an inch or more apart on the walls, with four (six) nailings to a lath and with joints broken every 18 inches; all are to be

put on horizontally. No laths to stop and form long, straight vertical joints, nor are any laths to be put on vertically to finish out to angles or corners. No laths are to run through angles and behind studding from one room to another. All corners are to be made solid before lathing. Should this contractor find any angles which have not been made solid, or any furring or studding which is not secured, he is to stop and notify the carpenter to make the same solid and secure.

Metal Lathing.—Walls or partitions in front of hot air flues, etc., are to be lathed with metal lathing approved by the architect. All recesses in brick walls that are to be plastered, all wood lintels and all places where woodwork joins brick walls (if the latter are not furred) are to be covered with or expanded metal lathing properly put up and secured.

WIRE LATHING WITH METAL FURRING.

This contractor is to fur all ceilings, soffits of stairs, all timber beams and posts, and both sides of all wood partitions throughout the building with metal furring, and a line of furring is to be placed on each side of each angle, as near the angle as possible. Posts and girders are to be furred lengthwise, with a line on each angle, and every inches between.

(If the architect does not wish to specify any particular or patent kind of furring he can specify 3/32 inch by 7/8 inch corrugated band-iron, put up with 1 3/4 inch staples.)

All furring is to be substantially secured with and to be set to give a true and even surface for the lathing.

This contractor is to cover all the above surfaces with (plain, painted, japanned, galvanized) wire lathing (2 1/2 x 2 1/2) (2 1/2 x 4) mesh, No. (20) wire, tightly stretched and secured with (2) inch No. 13 steel staples driven over the lath and furred at each bearing where the lathing runs crosswise of the timbers, and every (6) inches where the bearings run parallel with the timbers. The lathing is to be lapped at least 1/2 an inch where the strips come together and 1 1/2 inches at all angles of walls or of walls and ceilings.

STIFFENED WIRE LATHING.

Over Woodwork and Brickwork.

This contractor is to cover all ceilings, soffits of stairs, both sides of all wood partitions, and all wooden posts and girders throughout the building with the stiffened wire lath, painted, No. 20 gauge, and (2 1/2 by 2 1/2) (2 1/2 by 4) mesh, with (1/2 inch) V-ribs. [On posts and girders and on planking 1 inch ribs will give better protection from both fire and dry rot.]

The lathing is to be applied with the ribs running at right angles to the beams; it is to be tightly stretched and secured with inch galvanized steel nails, driven through each end of each rib, and at every bearing between; and every 9 inches on timbers and planking. The stripes are to lap on a joist in every case and are to be carried down 2 inches on the walls.

The outside walls of the finished portion of basement, from floor to ceiling, are to be lathed with stiffened lathing, painted, No. 20 gauge, (2 1/2 by 4) mesh and 1 inch V-ribs. The lathing is to be tightly stretched, lapped 1 inch, and secured to the walls with steel nails driven through the ribs every 8 1/2 inches and at each end. The lathing is to be applied with the stiffening bars in a vertical position. All this lathing is to

be done in the most approved manner, so as to give a firm surface upon which to apply the plaster.

METAL LATH OR IRON WORK.

This contractor is to furnish and put up in a substantial manner all iron furring and lathing for enclosing the posts and girders and for forming the cornices, as shown on the drawings and as specified below. The lathing is to be well lapped over on the walls and ceilings to make a tight job.

Girders.—All girders projecting below the level of ceilings are to be encased with wire lathing, stiffened with 1/4 inch solid ribs. The lathing is to be rightly supported by light iron furring built out to the correct outline as shown on the plans. The furring is to be so designed that the weight of the plaster and falsework will be supported by the girders and firm surfaces afforded for plastering.

Cornices.—Full-size details of all cornice-work is to be supplied by the architects at the proper time. Iron brackets, bent to correct outlines, and spaced not more than 18 inches apart, are to be secured in position in the best manner and well braced. Over this falsework, wire lathing, stiffened with 1/4 inch steel ribs, is to be laced so as to conform with the profiles of the brackets and produce smooth, firm surfaces for plastering.

Columns.—All columns not enclosed in brick work are to be wire-laced. Suitable light iron furring is to be provided so as to offset the lathing at least 2 inches from the ironwork and finish round or square, as shown on the plans. The lathing is to be stiffened with 1/4 inch solid ribs woven in every 7 1/2 inches.

All Other Exposed Ironwork.—This is to be suitably encased with wire lathing supported whenever necessary by light iron furring, and in all cases providing an air-space of at least 1 inch between the ironwork and the plaster.

All of the above lathing is to be painted (galvanized), of No. 20 gauge and (2 1/2 by 4) mesh and is to be securely laced to the furring with No. 19 galvanized lacing wire.

SOLID PARTITIONS.

Metal Lath and Studding.—This contractor is to provide all steelwork for and erect the partitions indicated on the plans, and leave them in perfect condition for the plasterer. Wood furring will be furnished in pieces of the proper size by the carpenter, but this contractor is to secure them to the metalwork. The above partitions are to be formed of studs of channel-iron, placed on centers for partitions feet or less in height and inches on centers for partitions more than feet in height. All openings are to be framed with 1 by 1 inch by 3/16 inch angle-irons.

1. The studs are to be securely fastened at the top and bottom and the grounds for the door and window openings are to be firmly secured to the studs. Grounds for the nailing of base, chair rail, picture moulds, etc., are to be fitted and fastened in place and

made true and straight, $\frac{1}{2}$ an inch over the line of studs on the face side of the partitions and $\frac{1}{4}$ of an inch over the line of studs on the reverse side, the total thickness being inches.

2. After the grounds are put on, the face side of each partition is to be covered with metal lath; the sheets of lath are to come close together or lap on the horizontal joints and the vertical joints are to be broken properly; the lath is to be secured by nailing on with (trunk) nails, driven through alongside of studs and clinched around behind them, each nail being on the opposite side of a stud from the one above and below it. The metalwork is to be properly braced to hold it in position until the mortar has become firm.

[The bracing should be straight-edged flooring boards put on over the lath. Staples set around the studs and driven into the boards can be easily drawn afterward, leaving only 1-inch strips on the face of each partition and the staple holes on the reverse to be filled in after the partitions have become rigid.]

[For wire lathing the specifications are to be as follows, instead as above.]

3. After the grounds are put on, one side of the partition is to be covered with No. 20 painted ($2\frac{1}{2}$ by 4) mesh wire lathing, stiffened with $\frac{1}{4}$ inch solid steel ribs, woven in at intervals of $7\frac{1}{2}$ inches, the rods running crosswise of the studs. The lathing is to be firmly secured to the studding with No. 19 galvanized lacing wire.

PLASTERING.

Back-plastering (for frame buildings).—This contractor is to back-plaster the entire surface of the exterior walls between the studs from sills to plates, and also between the rafters of the finished portions of the attic, on laths nailed horizontally, $\frac{3}{8}$ of an inch apart, to other laths or vertical strips put on the inside of the boarding with one heavy coat of lime-and-hair mortar, well trowelled and made tight against the studs, girts, plates and rafters.

One-coat Work.—The is to be plastered one heavy coat of rich lime-and-hair mortar, well trowelled and smoothed.

Three-coat Work.—All other walls, partitions, ceilings, and soffits throughout the building are to be plastered three coats in the best manner.

The first or scratch coat is to be made of first quality lump lime, clean, sharp bank (river) sand, free from loam, dirt or

salt, and the best quality clean, long cattle hair, mixed in the proportion of $5\frac{1}{3}$ barrels of sand and $1\frac{1}{2}$ bushels of hair to each 200 pounds of lump lime. All are to be thoroughly mixed by continued working and stacked in the rough for at least (7) days before putting on. The hair and sand are not to be mixed with the lime until the lime has been slaked at least six hours.

The scratch coat is to be properly put on and applied with sufficient force to give a good clinch, and is to be well scratched and allowed to dry before the brown coat is put on.

The second or brown coat is to be mixed in the same manner as the scratch coat (except that $6\frac{1}{2}$ barrels of sand and but $\frac{1}{2}$ a bushel of hair to 1 of lime may be used). The contractor is to level and float up the brown coat and make it true at all points.

White Coat.—The third coat (except in), is to be mixed with lime putty, plaster of Paris and marble dust (or lime putty and hard wall plaster), thoroughly trowelled and brushed to a hard, smooth surface.

Sand Finish.—The third coat in is to be composed of lime putty and clean-washed (beach) sand, floated with a wooden or cork-faced float to an even surface, with a texture corresponding to that of No. 1 sand-paper.

All lathing and plastering are to extend clear down to the floor; all walls are to be straight and plumb and even with the grounds; and all angles are to be maintained sharp and regular in form.

Plaster Cornices, etc.—The contractor is to run around a plaster stucco cornice, to extend inches in the ceilings and inches on the walls, and to be in strict accordance with the detail drawings. All beads, quirks, etc., are to be run to the angles of beam soffits as indicated on the drawings, and a finish to be made at each end of the beams with cast plaster brackets, modelled according to full-size details.

The contractor is to put up cast plaster centerpieces in rooms, for which he is to allow the sum of , to be expended under the direction of the architect.

The plastered is to clear out all boards, planks, horses, mortar, dirt and all loose rubbish made by him or his men, and remove such materials and rubbish from the rooms and premises as fast as the several storeys are plastered, and leave the floors broom-clean. He is to patch up and repair the plastering after the carpenters and other mechanics in a skilful manner and leave the work perfect on completion.

Inspection of Material and Workmanship, A. T. Byrne. Jno. Wiley & Sons, New York.

Cements, Limes and Plasters, E. C. Eckel. Jno. Wiley & Sons, New York.

Building Construction and Superintendence, F. E. Kidder. Wm. T. Comstock Company, New York.

Concrete Specification, J. Cochran. The D. Van Nostrand Company, New York.

Cement Specifications, J. Cochran. The D. Van Nostrand Company, New York.

STUCCO

SPECIFICATIONS FOR MIXING STUCCO WITH THE ADDITION OF HYDRATED LIME.

Mix with 10 parts Portland cement 1 part hydrated lime, dry—measured by volume.

Add dry, clean sand in proportions 1 part of cement-lime mixture to 2 parts sand.

Turn until mixture is of uniform color.

Add necessary water to make stiff plaster.

For first coat on wire or lath add one pound of good cow-hair for each bag of Portland cement used.

SPECIFICATIONS FOR MIXING STUCCO WITH LIME PASTE.

Dry mix 1 part Portland cement and 1 part sand, just before using.

With this mix 1 part lime-sand paste. Add water to bring to proper consistency.

To make lime-sand paste, slake double-strength lime for one week, strain and mix 1 part lime with 9 parts sand.

SPECIFICATIONS FOR STUCCO ON OLD BRICK.

Pick back the joints between the brick $\frac{1}{2}$ inch.

Clean surface with solution 1 part commercial muriatic acid and 5 parts water.

Wash off acid thoroughly.

Saturate surface thoroughly just before applying plaster, and keep wet as plaster is placed.

Start plastering at top of wall.

Make each coat continuous.

Stops shall be made only where natural breaks occur in the wall surface. If no breaks occur, plaster whole surface from edge to edge in one operation.

For proportions, see Specifications for Mixing Stucco.

SPECIFICATIONS FOR STUCCO ON FRAME HOUSES.

Framework.—Complete framework and exterior sheathing, making framework as stiff as possible.

Sheathing Paper.—Cover sheathing with heavy sheathing paper.

Furring strips (a or b can be used):

(a) Nail securely to the sheathing $\frac{5}{8}$ inch x 1 inch wood strips 9 inches on center.

(b) Staple securely to the sheathing $\frac{1}{2}$ inch metal furring strips 9 inches on center.

Lath (a or b can be used):

(a) Nail wood lath directly to wooden furring strips—lath to be painted with two coats of bitumen paint.

(b) Secure firmly to furring strips small-mesh metal lath. Lath to be dipped in paint made of equal parts neat Portland cement and water. Attach lath to furring strips immediately after dipping.

Plaster (See Specifications for Mixing Stucco).

Applying Plaster.—If lath has been painted with bitumen paint, start plastering after twenty-four hours and within six days of painting. If lath has been dipped in Portland cement paint, start plastering as soon as paint has become hard.

Start plastering at top of wall and make surface continuous from edge to edge.

Force plaster well into meshes of lath.

Scratch deeply over entire surface of first coat while wet.

Second Coat.—Mix second coat in same proportions as first coat without addition of hair.

Apply second coat as soon as first coat will bear pressure of trowel.

Make second coat from $\frac{1}{2}$ inch to $\frac{3}{4}$ inch thick.

Scratch second coat over entire surface while wet.

Third Coat.—Mix third coat same as second coat.

Apply third coat as soon as second coat is strong enough to support it.

Finish.—Obtain finish from third coat. ,

R. C. DANCY

Contracting Plasterer

TORONTO - CANADA

Office: 153 SPADINA ROAD

Telephone: HILLCREST 586

Yards: 75 BLOOR ST. WEST & 54 YORKVILLE AVE.

Products Metal Furring, Lathing and Plastering of every description, including Mycenian marble, imitation stone of various kinds. The use of Caen stone, Portland and Keene's cements a specialty.

Equipment I am prepared to handle contracts of any size throughout Canada, in record time, using only first class materials and workmanship. Estimates furnished on request.



Board Room, new Bank of Toronto
Ornamental Ceiling executed by R. C. Dancy

A Few Contracts Recently Completed	<p>Messrs. Ryrie Bros., Limited, new ornamental ceilings in store.</p> <p>New Bank of Toronto, Head Office Building, Toronto, 1912.</p> <p>Mutual Life Assurance, Head Office, Waterloo, Ont., 1912.</p> <p>Central Y. M. C. A. Building, College St., Toronto.</p> <p>New Toronto General Hospital, Pathological, Out-Patients and Emergency Buildings.</p> <p>University of Toronto, Museum Building, Toronto, 1912.</p> <p>The Royal Alexandra Theatre, Toronto, 1912.</p>
---------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

GLASS AND GLAZING

HT.

used by the inter-
determined by ex-
: $\frac{1}{4}$ inch rolled
ce sheet glass, 17
however, depend-
ence at which the
and character of
light is reflected.
lay an important
Many rolled pat-
r the loss by re-

fraction and un-
compare any two
or more glasses for lighting power, they may
be placed in photographic printing frames
with ordinary P. O. paper, and set in the
same position and at the same angle as the
glass is to occupy. Observation must be made
at frequent intervals.

PATENT GLAZING.

There are many systems of patent glazing
without putty so arranged that replacement
of breakage is easy without recourse to skill-
ed labor.

Every good system of glazing without putty
should possess the following characteristics:—

(a) It should be simple in construction, so
as to be easily repaired by ordinary work-
men. Broken panes should be easily re-
placed.

(b) It should allow of expansion and con-
traction under changes of temperature without
breaking the glass.

(c) It should be of such a structure and
strength that men can easily get at any part
of it for cleaning and repairs.

(d) The fastenings and metal parts should
be so placed as to be protected from corrosion
by the weather.

(e) It should not be obscured by heavy
framing or sash-bars, but should give a good
proportion of light for the area which it
covers.

In ordering prismatic glass, the following
data should be given:—

(1) Number of lights, (2) width, (3) height,
(4) distance to nearest building obstructing
the light, (5) height of building opposite
openings to be glazed, (6) distance from top
of window to the ground, (7) distance from
top of window to the floor, (8) does opening
face north, south, east or west? (9) width of
room, (10) length of room, (11) height of
ceiling, (12) if glass is not flush with face of
building, note distance from glass surface to
face of building.

SPECIFICATION CLAUSES.

GENERALLY.

All glass to be of the best quality of its
respective specified kind.

Where fixed in putty, to be well bedded and
back puttied, and the glass to be also sprigged
in where necessary. Linseed oil putty only
to be used.

All putty to be carefully trimmed and
cleaned off.

Provide all copper clips, screws, pins, etc.,
as required for fixing.

Black the edges of plate glass where re-
quired to prevent reflection of light. All
glazing in doors to be bedded in (leather)
strips, and fixed with beading.

All fluted and pattern glass is to be cut
and fixed with the pattern vertical or hori-
zontal as required, and the whole is to be
uniform.

WINDOWS.

The windows of to be glazed with
21 ounce sheet glass, seconds (or thirds), in
putty.

The windows of to be glazed with
 $\frac{1}{4}$ () polished plate glass, on putty
(or beads).

DOORS.

The doors to be glazed with plate
(described fully), bevelled on one side and
fixed in beads with rubber bedding.

PAVEMENT LIGHTS.

Provide feet super. of patent
pavement lights at a value of per
foot superficial, and fix in pavement where
shown on drawings, according to directions
of the manufacturers.

TOILET ROOMS.

Glaze all windows of lavatories, shafts,
w. c.'s etc., with (ornamental rolled glass),
double thick, of simple pattern, approved by
architect.

BASEMENT.

Glaze all outside windows of basement with
or other approved lights selected by
the architect.

COMPLETION.

Take out and renew all cracked, damaged,
scratched or defective glass, and leave all
glazing sound and perfect at completion.

STAINED AND LEADED GLASS.

All materials and workmanship to be of
the best of their respective kinds.

Sketches to be submitted for, and full size
working drawings approved of, all work be-
fore proceeding.

All stained glass to be of a permanent char-
acter, well fired.

Lead lights to be thoroughly cemented on
both sides and guaranteed weather tight. All
joints well soldered.

Provide and fix feet super. of lead-
ed lights, glazed, of 21 ounce sheet
quality, in diamond shaped panes about 7 by
5 inches in heavy $\frac{3}{8}$ inch leads, and fixed with
 $\frac{3}{8}$ inch saddle bars in mild rolled steel (iron
or bronze). Long dimension vertical.

Provide and fix feet super. of ornamental leaded lights of approved design.

Provide and fix panels containing feet super. of stained glass.

Provide and fix panes (embossed), (bevelled) plates of approved design in the entrance door, etc.

WIRED GLASS.

To have a thickness of at least $\frac{1}{4}$ inch at the thinnest point.

Wire mesh to be not larger than ($\frac{7}{8}$) inch, and no wire used for such mesh to be smaller than No. 24, B. & S. gauge. The plane of the wire mesh to be practically midway between the two surfaces of the glass.

All wire to be of galvanized iron and of a quality soft enough to permit all necessary

bending without not to flake or break.

Selvage to be reinforced framing.

The glass to be part of the frame the material which proof purposes. material to be used in

B

Where the wall curve, bent glass corresponding curves walls are to be glass plate glass. In drawings, at front to be best bent joint with flat glass

CONSOLIDATED PLATE GLASS COMPANY OF CANADA LIMITED

TORONTO
241 Spadina Avenue

MONTREAL
30 St. Sulpice Street

WINNIPEG
375 Balmoral Street



Product EVERYTHING in GLASS for BUILDING PURPOSES.

We handle Plate Glass, Sheet Glass, Figured Glass, Art Glass, Prism Glass, Sidewalk Prisms, Mirrors and Metal Store Fronts.

Variety We have the largest assortment of Window Glass in Canada. We can supply all the glass used in any size building and any kind of glass on short notice.

Estimates Estimates gladly furnished on jobs of every size. We furnish samples to Architects on request.

Service We will be pleased to co-operate with customers in the selection of glass to suit their requirements. We have had years of experience in handling Glass and are ready at all times to give our patrons the benefit of our knowledge.

Let us figure on your next specification.

THE HOBBS MANUFACTURING COMPANY Limited

FACTORIES AND WAREHOUSES:

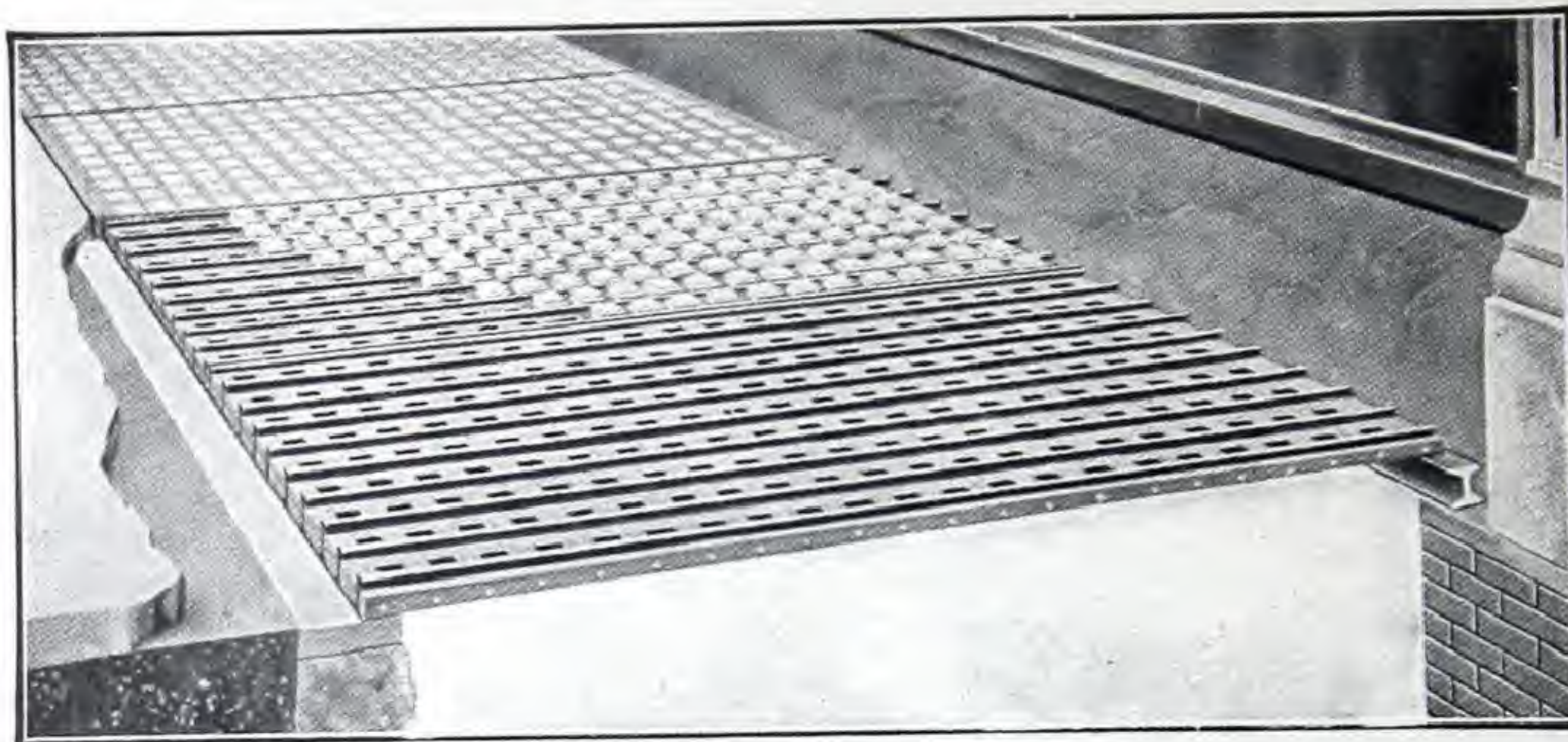
LONDON

TORONTO

MONTREAL

WINNIPEG

Product Simplex double reinforced pre-formed concrete sidewalk construction with prism or plain glass.



SIMPLEX construction showing method and simplicity of installation.

**Descrip-
tion**

Simplex is an absolutely new method of construction, and the only sidewalk light conductor that will prevent the glass from shaling and which will also make leakage impossible. Shaling of the glass and leakage caused by expansion or contraction have been the principle drawbacks in former sidewalk constructions. The Simplex system with its double reinforcement of the cement and the cushioned malleable coating on the glass (both covered by patents) entirely overcomes these difficulties.

**Steel Rein-
forcement**

The Steel reinforcement in Simplex is exceptionally strong and it is only necessary to have bearings on two sides, dispensing with the light-obstruction cross beams. The reinforcing bars are entirely protected by the concrete and are thus immune from corrosion.

**Simple
Install-
ation**

Experts are not required for the proper installation of Simplex as the lower portion of the concrete work is made up at our factory, and the upper portion can be completed by an ordinary cement mechanic after the glass has been set in position.

**Construc-
tion**

On account of its structural formation Simplex has greater strength for its weight than any other form of vault light construction.

THE TORONTO PLATE GLASS IMPORTING CO. LTD.

- Products** Glass for Buildings, plate glass and metal store fronts, also figured and colored glass. Bevelling, ornamenting and domestic and Church art glass.
- Mirrors** Mirror for storefittings, decorating theatres, etc., and for furniture.
- Bent Glass** We bend glass at Toronto for all manner of buildings in a few days from receipt of order. Patterns may be taken when work is erected.
- Glass Wall Tiling** Superior tiling for walls of bathrooms, halls, kitchens and public buildings and can be set on existing surfaces without further preparation.
- Domestic Art Glass** Suggestions and designs on request.
- Church Art Glass** Contracts made to install art glass in Churches anywhere. On request, designs and samples sent or Artists to confer with Architects and Church committees with full sized sample windows.
- Metal Construction Store Fronts** This is the newest, neatest and most attractive store front and is made in any metal or finish desired. We contract to make complete installations of glass and fronts. Estimates, designs and working drawings supplied; suggestions and sketches furnished.
- Estimating and Contracting** We maintain an efficient staff for preparing estimates and consulting on all glass for buildings. We contract for supplying glass required regardless of quantity, to all parts of Dominion.
- Ornamenting** We manufacture chipped, embossed, acid embossed, sand embossed work, also all manner of glass signs, etc.

THE TORONTO PLATE GLASS IMPORTING CO. LTD.

Trade Prices of Bulged Panes

For Casement, Sash, Transoms, and Interior Work

Made of Good Quality 16-oz. Glass		Price (each) Glass included
Panes not over	7 x 7.....	\$0.15
"	" 8 x 8.....	.18
"	" 9 x 9.....	.22
"	" 10 x 10.....	.26
"	" 11 x 11.....	.30
"	" 12 x 12.....	.35

These panes are glazed in the ordinary way with good putty, and not with stops. They make an exquisite window, and give a very high-class tone to an elevation, not obtainable with ordinary glass.

Oblong panes at same prices as above at equivalent areas.

Special Trade Prices of Glass Bending

Ordinary sweeps are those bends which are curved one way of the panes, not exceeding $\frac{1}{4}$ circle.

PLATE GLASS		Price per Foot
When bent to sweep not exceeding $\frac{1}{4}$ circle one way of the glass		
Panes not exceeding 76 united inches.....		\$0.60
" exceeding 76 not exceeding 90 united inches.....		.75
" " 90 " " 100 " "		1.00
" " 100 " " 110 " "		1.20
" " 110 " " 120 " "		1.60
" " 120 " " 140 " "		2.00
" " 140 " " 160 " "		2.40
" " 160 " " 180 " "		2.80
" " 180 " " 200 " "		3.20
" " 200 " " 210 " "		3.60
" " 210 " " 220 " "		4.00
" " 220 " " 230 " "		4.40
" " 230 " " 240 " "		4.80

SHEET GLASS		Price Per Foot
Double thick, when bent not exceeding $\frac{1}{4}$ circle one way of the glass.		
Panes not exceeding 60 united inches.....		\$0.25
" exceeding 60 not exceeding 70 united inches.....		.30
" " 70 " " 80 " " .....		.40
" " 80 " " 90 " " .....		.50
" " 90 " " 100 " " .....		.60
" " 100 " " 110 " " .....		.90

Single Thick Glass, when not over 60 united inches, 20% less.

Larger Plates: Prices on application.

Continued on next page

THE TORONTO PLATE GLASS IMPORTING CO. LTD.

Panes one part flat and one part bent, the bent part to be $\frac{1}{3}$ or more of the width, and also circular panes exceeding $\frac{1}{4}$ circle and not exceeding $\frac{1}{3}$ circle—25% advance.

Panes two parts flat and one part bent, the bent parts to be $\frac{1}{2}$ or more of width—40% advance.

Prices for more difficult shapes on application.

32-oz. Sheet Glass—20% advance on double thick prices; also Rolled Cathedral, Figured Rolled Glasses and $\frac{1}{8}$ Rolled Plate not over 50 inches long or wide—10% advance on double thick bending prices.

Rolled Plate and other Glasses in larger sizes than mentioned in above paragraph, also Rolled Plate and other Glasses over $\frac{1}{8}$ -inch and not more than $\frac{3}{8}$ -inch thick, of any size—bending prices same as plate glass with a further discount of 25%.

Plate Glass and Sheet Glass when ground, chipped, embossed or similarly ornamented—10% in addition to prices for extra risk in bending.

Bending Bevelled Plate Glass

Glass already bevelled cannot be received for bending. Special prices for bevelling bent glass on application.

Boat Panes, Panes Conical, Winding, or those not having parallel sides or ends, are charged net list.

Minimum charge for bending any one order is 50c. for Sheet Glass, and \$1.00 for Plate Glass, and other glasses, glass included.

Panes less than 12 inches wide will be charged as 12 inches wide.

Panes in quantities of 10 or more, less than 12 inches long and wide—special prices on application.

All bending is charged with fractional portions of inches as the next even inch.

Bending is not guaranteed exact, edges straight, flat parts flat or any two panes alike, owing to inequalities in expansion and contraction in moulds and glass, but our work will be found to be so exact as to avoid any reasonable complaint, extra large plates, and those exceeding ordinary sweeps are liable to be mould marked.

Where glass is to be put in metal frames, we advise these to be sent to our works, or provision made for adjustment. A charge is made for fitting in all cases when frames or sashes are sent to have bent glass fitted to same.

Glass supplied at current market prices.

Discounts Off Trade Lists

Bulged panes—from 10% to 20%, according to the importance of the order.

Glass bending—from net list single panes to 40% off for bending sheet glass.

And from 40% off for bending single plates to 50% off for bending quantities of plate glass.

Discount for bending will be 10% less in every instance when we do not supply the glass.

Above prices and conditions are only for glass and bending on the floor of our works. Packing charged at cost.

CHANCE BROTHERS & COMPANY LIMITED

GLASS WORKS

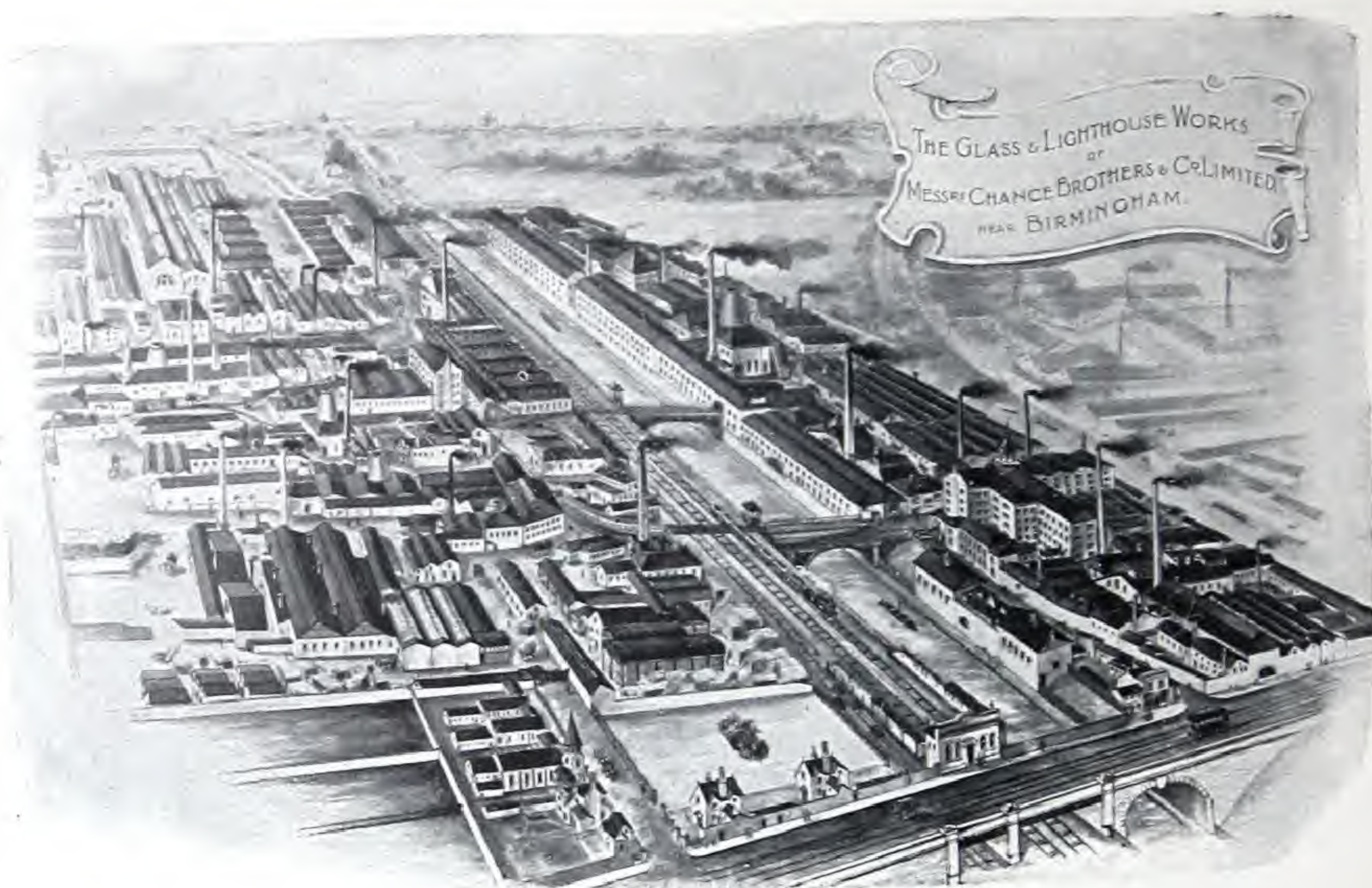
Near BIRMINGHAM, ENG.

Branch Works, GLASGOW

Canadian Representatives

B. & S. H. Thompson & Co., Limited
Montreal

Bogardus Wickens, Limited
Vancouver

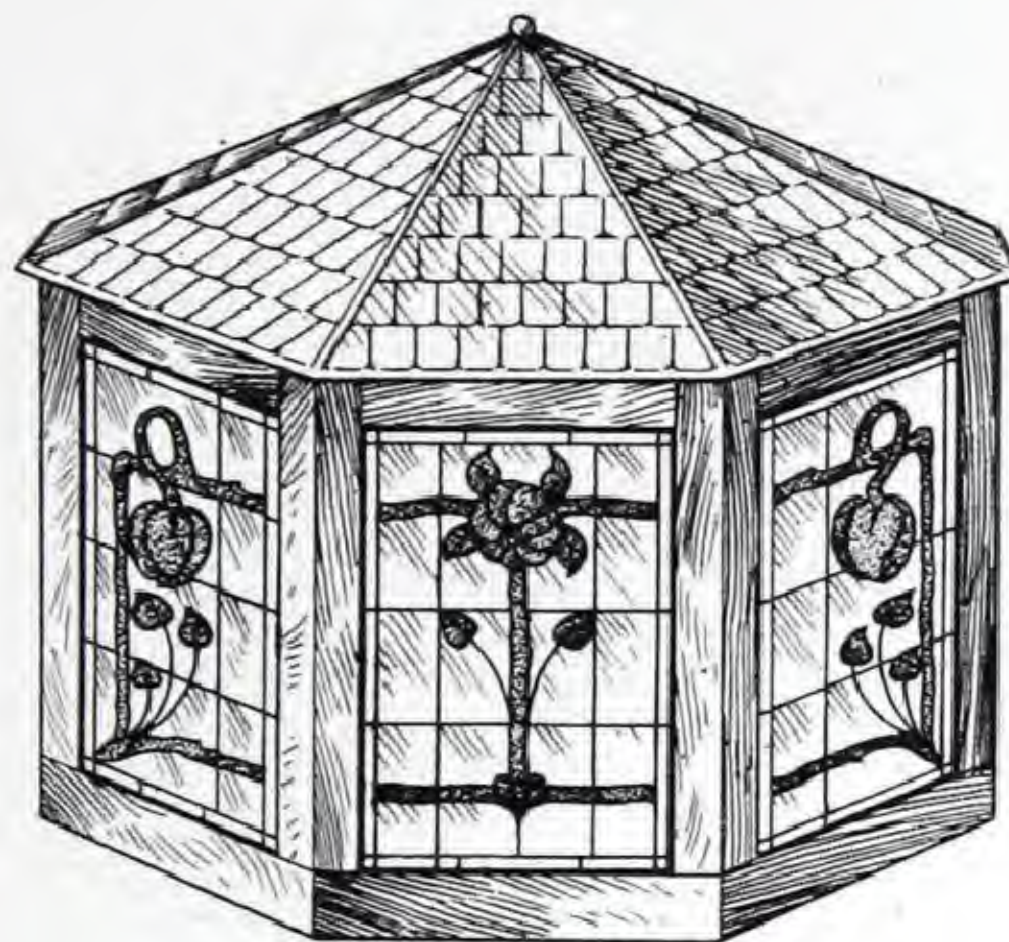


Product	Glass for all kinds of glazing in Windows, Roofs, Doors, and for all building purposes. Figured, Rolled, Rolled and Rough cast Plate.
Orna- mental	Cathedral Flemish Muffled, etc., etc.
Tiles and Mosaic	Vitreous Tiles and Mosaics for internal and external work on walls, ceilings, floors, etc.
Inform- ation	Samples, Catalogues and full particulars to be obtained either from our Agents or direct. Estimates gladly furnished on all stock mentioned above.

DOW'S GLASS SUPPLY

817 Gerrard St. East - - Toronto

Phone: Gerrard 577



**Manufac-
tures** Stained and Ornamental Leaded Lights for dwellings, stores and churches.

Products Plate and Sheet Glass, Mirrors—Bevelled and Plain—Chipped and Embossed Glass for Decorative purposes.

Contracts We estimate for Glazing including every kind of work for stores, factories and Warehouses.

Architects designs accurately followed.

**Workman-
ship** All work executed is of superior and durable workmanship.

“The JEFFERYS”
STAINED AND
LEADED GLASS



400-8 Wellesley Street
96-8 E. Adelaide Street
TORONTO, ONT.

PHONES: NORTH 6092 :: MAIN 5006



DESIGN

Canadian Art
is our speciality and
we work from
designs produced
by the architects,
and invite
consultation.

Accompanying il-
lustration is of a
window, de-
signed by
C. W. Jefferys,
A.R.C.A.,
and executed by
W. Jefferys
for the residence
of R. H. Schmidt,
Newmarket, Ont.

J. A. SOMERS

WM. THORP

NATIONAL PLATE GLASS & MIRROR WORKS

Importers of Plate, Sheet Glass, Etc.

11 Nelson Street
TORONTO
CANADA

Our Main Lines	Plain Plate Mirrors	Bevelled Plate Mirrors
	Plate Glass Shelves	Bevelled Door Plates
	Plate Glass Tops	Plate Glass Desk Tops
	Plate Glass Dresser Top	X. L. Mirrors
	Show Case Work	

We cut, chip, bevel, and silver any pattern to order

Specialty Glass Panels, Glass Partitions, Plain and Ornamental Glass Work for Private Residences, Public Buildings, Banks, Schools, Churches, Offices and Factories.

Mirrors We manufacture everything in Mirrors (Plate or Shock) from the Largest Pier Glass to the Smallest Bathroom Mirror.

Old Mirrors Resilvered and made as Good as New.

Design We work from designs produced by Architects and will be glad to co-operate at any time with the Architect in designing.

Work specified to be done by us will receive careful and personal attention.

Service We invite correspondence, and will be pleased to have our representative call and give estimates.

PAINTS AND VARNISHES

LINSEED OIL.

Good raw linseed oil is pale in color and transparent, has very little odor and is sweet to the taste. If it is dark in color and dries very slowly, it indicates an inferior oil. Linseed oil should have an age of six months before being used, and more age improves it. Raw oil spread on glass should dry in from two to three days, according to the state of the weather.

Boiled linseed oil, commonly called boiled oil, is prepared by heating the raw oil with certain driers. By this process the drying qualities of the oil are greatly improved; the drying qualities of raw oil are also improved by simply boiling it.

Boiled oil is much thicker and darker in color than the raw oil. When spread on a glass in a thin film it should dry in from twelve to twenty-four hours, depending on the condition of the weather.

Raw oil is used for interior work and for grinding colors; the boiled oil is used for outside work, and is not suited for grinding. Boiled oil gives paint a much more glossy finish than the raw oil, for when the raw oil is used, a liquid or other dryer must be added, and this takes away the lustre from the oil.

Fish oil, cotton seed oil, and vegetable oils, are often substituted for boiled oils.

Linseed oil to which turpentine has been added ((in small quantity) dries more rapidly than without the turpentine, because it spreads over more surface, being thinner, and so comes in contact with a larger body of air.

Turpentine is not a drier, simply a thinner.

Linseed oil is often adulterated by adding fish hemp, cotton seed, mineral oils or resin. These adulterations are hard to detect except by chemical analysis; they change the odor somewhat, and the specific gravity.

Tests.

The architect should always keep himself in possession of a sample of both the raw and boiled oils which he knows to be pure, and with which he can compare any oils which may be used under his supervision.

Good linseed oil should be of a light straw color, weigh 9 pounds to the gallon, boil at 130 degrees C. (260 degrees Fahr.), solidify at 27 degrees C. (17 degrees Fahr.), and have a specific gravity of 20 degrees Baumé (0.932).

To test for the presence of fish oil, shake equal parts of oil and strong nitric acid in a small glass vial and let it stand fifteen to thirty minutes. In pure linseed oil the upper stratum will be olive-green, which gradually changes to a brown, and the lower stratum will be almost colorless; if fish oil is present, the upper stratum will be of a deep red brown and the lower stratum will be deep red or cherry red. If only a small amount of fish oil is present, the color of the lower stratum may gradually disappear until it becomes almost colorless.

To test for petroleum, shake the oil with a concentrated solution of potash or soda con-

taining a little ethyl alcohol, and then add a little warm water and shake again. Let it stand for about thirty minutes, and if any petroleum is present it will separate and float on top.

To test for cotton seed oil, put samples of the oil in tubes and place them in a freezing mixture such as ice or snow and salt. If the mixture solidifies at zero or 10 to 13 degrees Fahr., then cotton seed oil is probably present, as pure linseed oil solidifies at 17 degrees Fahr.

Hydrometer Tests.

First test the specific gravity of an oil known to be pure, and then test the doubtful oil at the same temperature.

Twenty-five per cent. of cotton seed oil will make a difference of 1 degree Baumé less than pure linseed oil at the same temperature.

Ten per cent. of petroleum will make a difference of $\frac{3}{4}$ degrees less and 20 per cent. will make a difference of $1\frac{1}{2}$ degrees less at the same temperature.

The quality of linseed oil may be determined by looking through a vial filled with it and turned towards the light. If poor in quality, the oil tends toward opacity, appears turbid or milky, while its taste is strong and rancid.

TURPENTINE.

The ordinary use of turpentine is to thin oil paints, to flatten white and other colors, or to remove superfluous color in graining. It prevents paint, however, from bearing out, and when used alone will not fix the paint on the surface to which it is applied.

Good turpentine is colorless and has a pleasant pungent odor; if adulterated or of an inferior quality, it will have a disagreeable odor, but odor is an exceedingly poor guide to follow in judging quality.

When evaporated, good turpentine should have a very slight residue, and when spread on a glass in a thin film, should dry in twelve to twenty-four hours.

Turpentine is often adulterated with mineral oils. The pure turpentine loses bulk by evaporation and gains weight upon exposure to the air. Adulterated with mineral oils, the spirit evaporates, leaving the oil without any assistance in hardening.

Turpentine containing such oils will usually leave a greasy stain on white paper, a drop of it on a watch crystal will reflect prismatic colors in the direct rays of the sun, and the hydrometer will stand in such a mixture above 32 degrees.

But little, if any, turpentine should be used on good work. The result of the use of turpentine is that the proportion of oil is reduced. This enables the painter to conceal the painted surface with fewer coats than would otherwise suffice. Turpentine also hastens the drying of the paint by reducing the quantity of the oil, and the turpentine itself possessing some oxidizing or drying properties.

Tests.

Good turpentine should be crystal clear and water white, weigh 7 pounds to the gallon, boil at 160 to 165 degrees C. (320 to 340 degrees Fahr.), and have a specific gravity at 15 degrees C. (59 degrees Fahr.) of 31 degrees Baumé hydrometer (0.870).

The presence of benzine or naphtha in turpentine can usually be detected by the odor; with the hydrometer test 5 per cent. of this adulterant will make a difference of $1\frac{1}{2}$ degrees Baumé.

The presence of petroleum can usually be detected by the delicate "bluish bloom" or smoky bluish yellow cloud it imparts to the turpentine.

To detect small quantities of petroleum, fill two white glass vials, one with the doubtful article and one with turpentine known to be pure; hold both over a piece of black paper and look directly down into the liquid; 3 to 5 per cent. of petroleum will impart a decided bloom or cloud to the turps. With the hydrometer test 5 per cent. of petroleum will make a difference of $\frac{1}{2}$ degree Baumé.

Pure turpentine at 15 deg. C. (59 deg. F.) is 31 deg. Baumé hydrometer.
 5 per cent. benzine at 15 deg. C. (59 deg. F.), is $32\frac{1}{2}$ deg. Baumé hydrometer.
 15 per cent. benzine at 15 deg. C. (59 deg. F.), is 34 deg. Baumé hydrometer.
 25 per cent. benzine at 15 deg. C. (59 deg. F.), is 38 deg. Baumé hydrometer.
 5 per cent. petroleum at 15 deg. C. (59 deg. F.), is $31\frac{1}{2}$ deg. Baumé hydrometer.
 10 per cent. petroleum at 15 deg. C. (59 deg. F.), is 32 deg. Baumé hydrometer.
 25 per cent. petroleum at 15 deg. C. (59 deg. F.), is 34 deg. Baumé hydrometer.
 33 $\frac{1}{3}$ per cent. petroleum at 15 deg. C. (59 deg. F.), is $36\frac{1}{2}$ p. c. Baumé hydrometer.

SUBLIMED LEAD.

Is obtained in the smelting of lead ores. The products of this smelting are pig lead, slags, and the "fume," which is white and in a fine state of subdivision, suitable for a white pigment, and is sold as such either dry or ground in oil. It is widely used and is a very satisfactory painting material.

Tests.

White lead may be either pure or mixed with various substances, such as sulphate of baryta, sulphate of lead, sulphate of lime, whiting, chalk, zinc white, etc.; these substances do not combine so well with oil as does white lead, nor do they so well protect the surfaces to which they are applied.

Sulphate of baryta, the most common adulterant, is a dense, heavy, white substance, very much like white lead in appearance. It absorbs very little oil, and can usually be detected by the gritty feeling produced when the paint is rubbed between the fingers.

Pure white lead is insoluble in water, effervesces with dilute hydrochloric acid, dissolving when heated, and is easily soluble in dilute nitric acid. When heated on a piece of glass the white lead becomes yellow.

To test dry lead, digest a small quantity in dilute nitric acid, 1 to 1, in which it dissolves readily on boiling. When ground with oil, the

oil should be burned off and the residue treated with nitric acid; or the white lead ground with oil may be boiled for some time with strong nitric acid, which destroys the oil and dissolves the lead on the addition of water. If sulphate of baryta be present, it being insoluble in the acid, it remains behind and can be collected on a filter, washed with hot distilled water, and weighed.

The presence of other adulterants may be detected by the change in the specific gravity of the lead when dry, or by various methods of analysis.

ZINC WHITE.

Zinc white is hydrated zinc carbonate or oxide. For inside work, zinc is preferable to white lead, and for outside work, about 25 per cent. of zinc mixed with the white lead makes a better paint than the pure lead. For use in its pure state, zinc white should be finely ground in refined linseed oil with the proper proportions of manganese drier, and if for interior use, should have a small proportion of good white varnish.

In painting in pure zinc, the first coat may be tinted with black, over which the second coat will make a perfect covering.

A soft brush with long hairs should be used, brushing lightly, and the paint should be applied a little thicker than a lead paint.

Test.

The purity of zinc may be determined by washing out the oil with benzine and dissolving the pigment in sulphuric acid. Any residue shows the presence of other pigments. On a painted surface the presence of lead can be determined by scratching a spot through the paint and applying a drop of sodium sulphide of 100 degrees Baumé. If lead be present it will cause a decided discoloration.

PAINTS FOR STRUCTURAL STEEL.

Of late years it has become very generally the custom to use "ready mixed paints for structural steel. This is because hand mixing can never completely break up the pigment and incorporate it with the vehicle, and it has been shown to be at the places where small particles of unmixed pigment are left that the rusting begins. Iron oxide and graphite paints with various mixtures of these materials and mixtures with other substances, such as lead, barytes, etc., are chiefly used for this purpose.

Finely ground graphite in linseed oil is a favorite paint for metal; it flows well, is easily applied, and if well made gives excellent results.

Graphite is sometimes mixed with lampblack, to good advantage. Boneblack is also an important ingredient of "carbon" paints. Oxide of iron in linseed oil is used perhaps more than any other paint for structural steel work. Asphaltum is used either alone or in combination, and some of these asphaltic preparations are quite satisfactory. The fact is, that a really competent paint manufacturer can make a good paint out of any of these, and if the application is well and carefully done the results will be far in advance of what is commonly seen, for these are great differences in painters.

As regards the surface of structural steel covered by a gallon of paint, there is much difference of opinion among experts. Some say 300 to 400 square feet, others as high as 1,000 or 1,200. The truth is that any paint may be by a skilled workman brushed out into an exceedingly thin film, while ordinary usage gives one at least twice as thick. The most general opinion is that it is not wise to estimate more than 400 square feet to the gallon, one coat. Varnish paints cover less than oil, but if well made they are more durable.

RED LEAD (RED OXIDE OF LEAD).

This is one of the oldest pigments. It is a double oxide of lead prepared by subjecting massicot to the heat of a furnace, with an expanded surface and free accession of air.

Red lead is often adulterated with red oxide of iron, brick-dust, or mineral paints. To test, heat the red lead and treat with dilute nitric acid; the red lead will be dissolved and the adulterants remain. Boiling hydrochloric acid extracts the sesquioxide of iron from the residue.

OXIDE OF IRON.

Is produced from the brown hematite ores; the ore is roasted and separated from impurities and then ground.

DATA ON PAINTING.

One pound of paint will cover from $3\frac{1}{2}$ to 4 square yards of wood for the first coat, and from $4\frac{1}{2}$ to 6 square yards for each additional coat; on brickwork, it will cover about 3 and $\frac{1}{2}$ square yards, respectively. Colored paints will cover about one-fourth more surface than white paint.

Prepared shingle stains will cover about 200 square feet of surface if put on with a brush, or will be sufficient for dipping about 500 smooth shingles or 400 rough ones.

One gallon of liquid filler, hard oil finish, or varnish generally, will cover from 350 to 400 square feet of surface for first coat, and from 400 to 500 square feet of surface for subsequent coats.

One gallon of ready-mixed paint will cover 250 to 300 square feet of wood surface one coat, or 175 to 225 square feet two coats, or 125 to 150 square feet three coats.

White lead and oil will cover about 15 per cent. less than the above.

VARNISH.

Good varnish should dry and be free from stickiness in from one to two days.

The more oil a varnish contains the less liable it is to crack.

One pint of varnish will single coat about 14 square yards.

A gallon of varnish covers so much surface it hardly pays to use any cheap varnish in good work. First coat should be applied very thin—about one-half turpentine and

one-half varnish. Other coats can be used full strength. This will insure good color and will improve with age. Any amount of rubbing can be done that is desired, but three-coat work, with sandpaper after first coat and rubbing after last coat, makes good work for house finish.

Wax Finish.

Use beeswax cut with turpentine until as thin as linseed oil; apply with brush. Apply second coat with soft cloth and rub till dry; the more rubbed the better it will look. This will not show much finish at first, but in a few months the wood will gradually grow richer in color, and one of the most pleasing and restful effects to the eye is obtained. It produces what is called a dead finish. This does not scratch white, and if bruised at any time can be easily repaired with a little of the last coat, and should it grow dusky or too dull looking with age can be brightened up like new by rubbing with soft cloth wrung out of warm water.

There are several waxes on the market ready for applying to flooring without the necessity of preparing as above. Directions for application and maintenance are given by the manufacturers and, if followed out, a good finish will be obtained. Some of these preparations are highly concentrated and one coat will give the required finish.

Exterior Work.

For exterior work use only the best coach varnish, which is made from gums that will melt at not less than 550 degrees Fahr. This is the only thing that will stand the hot rays of the sun.

WOOD PRESERVATIVES.

There are a number of substances in use for the prevention of decay in timber and woodwork and also for the prevention of dry rot. When wooden pieces in large quantities are to be preserved, for pavement construction, or for railway ties, coal tar and creosote are commonly used, or one of the prepared wood preservatives; either brushed on or dipped. Sometimes the pieces, which should always be well seasoned and kiln dried, are boiled in the tar for some hours or else placed in an apparatus constructed for the purpose and subjected to considerable pressure, which forces the creosote into the pores of the wood.

For ordinary construction work a material that can be applied to the finished woodwork with a brush is most satisfactory. There are several such preparations on the market, all of which have proved effective. Some are supplied in only one color and others in several. There are numerous formulas in existence for preparing wood preservatives, but the reliability of the products resulting is very doubtful. In general it will be found cheaper and more sure to purchase well tested preparations from reliable manufacturers.

Chemistry of Paints and Paint Vehicles, C. H. Hall. D. Van Nostrand Company, New York.
Modern Pigments and their Vehicles, F. Maire. Jno. Wiley & Sons, New York.
Rustless Coatings, M. P. Wood. Jno. Wiley & Sons, New York.
Paints and Painting Materials, Gardiner & Scharfer. The McGraw-Hill Book Company, New York.
Corrosion and Preservation of Steel, Cushman & Gardner. McGraw-Hill Book Company, New York.
Industrial and Artistic Technology of Paints and Varnishes, Alva H. Sabin. Jno. Wiley & Sons, New York.

THE AULT & WIBORG CO. OF CANADA, LIMITED

Varnish Works

MONTREAL - TORONTO - WINNIPEG

Bitunamel Is absolutely damp proof, Anti-corrosive proof, weather proof, water-proof.

Bitunamel Unsurpassed for waterproofing foundations of new buildings. Specified and used on all buildings of the Board of Education and many of the largest buildings recently erected.

Bitunamel stands undisputed as the finest medium for preventing rust and corrosion on all exposed and submerged iron work. Used extensively by the Hydro Electric Systems and Railway Signal Companies.

Highest Grade Varnishes and Colors for all systems and purposes.

White Enamel—made in Flat, Dull Finish and High Gloss effect for interior and exterior work.



Hart Building, University of Toronto. Architects—Sproat & Rolph.
Water-proofed with Bitunamel.

Recent Contracts Victoria College, Sproat & Rolph, Architects; Burwash Hall, Sproat & Rolph, Architects; Fredricka Ave. School, Belfry, Architect; Sunlight Soap Co.; East Toronto Water Works Tower; Hydro Electric Standards, Shirley Ave. School; Williamson Road School; Keele St. School.

Information Correspondence solicited. Booklets, estimates, etc. on request.

WM. HARLAND & SON

Established 1791

FACTORIES:

London, Eng.

Toronto, Can.

Buffalo, N.Y.



"QUALITY BASED ON EXPERIENCE"

Business The World's Foremost Varnish Makers. Quality of our Products based on 120 years experience.

Notes on some of our Well Known Brands:

"Har-Spar" This Varnish is guaranteed as to its weatherproofing qualities. Will withstand effects of salt and fresh water. Adapted to all outside work.

"Wont-Mar" Harlands' "Wont-Mar" is an exceptionally efficient floor varnish. It dries hard and retains its luster.

"Har-Lastic Oak" For all interior finishing. Light colored, free working with good body. Dries hard in twenty-four hours.

"Snowite" Enamel As used by the British Navy and most of the Ocean Liners. Is adapted to all work where the best finish is required.

Flat Enamel Harland's celebrated flat enamel.

Stains We carry a complete line of Stains. Samples on wood will be sent on request.

Reference Sir Thomas Lipton's new America Cup-challenger is being finished throughout with our varnishes and enamels, a high tribute to our products.

Catalogues and Color Cards Catalogues, color cards and further particulars will be sent to Architects, and others on application.

WM. HARLAND & SON

Toronto, Can.

Merton, England

Buffalo, N.Y., U.S.A.

BERRY BROS.

(Incorporated)

ESTABLISHED 1858

Factories:

WALKERVILLE, Ont.
MILAN, Italy

SAN FRANCISCO, Cal.
DETROIT, Mich.

Liquid Granite

The Varnish for Floors.

Liquid Granite has stood the actual test of over thirty years severe and constant service and is recognized by master painters as the most perfect, durable, and elastic floor finish made.

More Liquid Granite is in use to-day than any other floor varnish.

"Luxberry" Wood Finish White

An interior varnish to be used where the finest gloss or rubbed finish is required; very pale in color, full bodied, flows perfectly and dries with a rich and durable finish. Is manufactured from the best gums and especially treated oils and we highly recommend it for use in offices and public buildings or where a finish of a high standard is required.

"Luxberry" Wood Finish Light

Same in quality as Luxberry wood finish, **White**, except for its color which is not as pale, but can be used on most woods without discoloring them in the least.

Elastic Interior Finish

For exterior work subject to severe exposure or usages. It possesses great elasticity, durability, and has greater resisting powers against hot soap and water than other varnishes.

Note

"Luxberry" Wood Finish is the registered trade name now used to designate the finish long and favorably known as Berry Bros. Hard-Oil Finish.

BERRY BROS.

Established 1858

Incorporated

“Luxberry” Spar Varnish For front doors, store fronts, all types of marine architecture and such exterior work as is subjected to severe exposure and changing weather conditions. It can be used for both an interior and exterior varnish. A reputation of 55 years behind this finish.

“Lack-lustre” For general Interior work where economy in labor is a consideration.

An ideal one-coat finish accomplishing in one coat what heretofore necessitated a coat of wax and of stain. Varnish can be applied over it without preparing the surface.

“Dulgloss” For interior Trim work where a flat finish is desirable. It is light in color, flows freely under the brush and produces in one coat an imitation rubbed effect over a shellaced varnished surface.

“Luxberry” White Enamel “A pure white that stays white.”

This enamel can be used on the finest interior or furniture work. Will rub perfectly in three or four days and can be polished on the fifth day to a piano finish.

“Shingle-tint” For Half-Timber work and shingle stain, possesses great penetrating and preservative qualities and prolongs the life of the shingles or wood by retarding decay.

Berry Bros. Cement Coating. A sanitary waterproof preservative coating for all cement and concrete surfaces in four colors suitable for interior and exterior work. Makes a hard glossy finish and can be rubbed if desired.

Berry Bros. Floor Wax A new combination of hard waxes adapted for finishing purposes making a hard finish.

Shellac We are direct importers of shellac gum, do our own bleaching and are therefore in a position to insure pure, uniform white and orange shellac at all times.

Service Correspondence solicited. Samples on wood and color cards on request. Varnish specifications for Architects' use.

THE IMPERIAL VARNISH AND COLOR CO., LIMITED

6-22 Morse St.

TORONTO

CANADA

WINNIPEG

108 Princess Street

VANCOUVER

43 Pender Street W.

Products "Maple Leaf Paints," "Maple Leaf Flat Wall Colors," "Duralite Enamel," "Artique Stains," "Creosote Shingle Stains," "Dry Colors," "Elastilite" varnish and "Orolite" Oil Finish. "Granite" Floor Finish and a full line of architectural polishing varnishes and finishing materials. Also driers, Shellacs, Paint remover, "Cemlite" cement, Stains, Paints and Sanitary Wall Coating and "Ferrox" iron and steel paint.

Trade Mark and Label All architectural lines are manufactured under the "Maple Leaf Quality" trade mark.

Maple Leaf Paint A high grade paint for exterior and interior use, made of the best raw material and so compounded as to give the highest protective results.

To Apply:—

See that the woodwork is dry, clean and free from dirt. Shellac with **Peerless White** or **Orange Shellac** all knots, sap and pitch spots. Apply first one coat of **Maple Leaf Primer**, and when dry putty all nail holes, cracks or other defects. This to be followed with two coats of **Maple Leaf Paint** in color desired. These goods shall be thinned only when necessary with pure raw linseed oil or pure spirits of turpentine.

One gallon of **Maple Leaf Paint** will cover upwards of 400 square feet, two coats.

Maple Leaf Flat Wall Colors A washable flat oil paint for the decoration of interior walls and ceilings. Expecially well adapted for use in hospitals, churches, asylums, schools, colleges, stores, offices, and other public buildings. A little soap and warm water keeps these colors perfectly clean and sanitary and they will not rub off.

To Apply:—

See that the wall surface is dry, clean and free from dirt and grease. All plastered walls, whether smooth, rough, sand finished or stucco finished and all wall boards may be finished as follows: First apply one coat of **Maple Leaf Wall Size** followed by two coats of **Maple Leaf Flat Wall Color** in shade desired. Twenty-four hours to be allowed between each coat for drying. **Never use Glue, Alum or Soap Sizes.**

One gallon of **Maple Leaf Flat Wall Color** will cover upwards of 300 square feet smooth wall plaster, two coats.

THE IMPERIAL VARNISH AND COLOR CO., LIMITED

CEMLITE CEMENT AND BRICK WATERPROOFING STAINS AND PAINTS

Water-proofing Where waterproofing alone is required on outside surfaces use **M. L. Cemplite Transparent**. On inside walls, ceilings or floors use **M. L. Cemplite Primer**.

Water-proofing and Staining **Cemplite Stains** combine to both waterproof and give color to the surface. It is not their purpose to cover in solid color similar to paint. They are intended for outside use only, to sink into the pores—to seal, protect and adorn.

Water-proofing and Painting Where it is desired to cover the natural surface solid and protect it against abrasion and wear use **Cemplite Paints**. On outside work use first **Cemplite Transparent**. On inside work first apply one coat of **Cemplite Interior Primer**. Let dry, then apply two coats of **M. L. Cemplite Cement and Brick Paint** as desired, allowing each coat to dry thoroughly hard before applying the next. **Maple Leaf Cemplite and Brick Paint** can be used without the primer where it is desired, but best results are obtained by using the primer, as described above.

MAPLE LEAF CEMPLITE SANITARY WALL COATING

A pure white coating for interior walls of warehouses, factories, bakeries, abattoirs, cold storage houses, wherever light surroundings are required and sanitary conditions must be observed. Two coats over brick, cement, concrete or wood gives a pure white surface.

DURALITE WHITE ENAMEL

For interior and exterior decoration.

Specifications for Duralite White Enamel All surfaces to be enamelled must be cleaned and sand-papered perfectly smooth. First apply one coat of **Maple Leaf White Primer** or lead and oil. Allow 48 hours to dry, smooth with fine sandpaper and apply two or three coats of **Floglaze Flat White**. Allow 24 hours between each coat for drying and smooth with sandpaper before applying the next coat. When all is thoroughly hard, apply one or two coats of **Duralite** as per directions on the can. Brush out well and allow 48 hours between coats for drying. Specially fine surfaces may be obtained by allowing the above coat to dry hard, then rub with pumice stone and water and apply a third coat of **Duralite**.

When used on metal surfaces, or for refinishing, it is not necessary to undercoat with **M. L. White Primer** or lead in oil. For dull or egg-shell finish, rub with pumice stone and water, using a piece of felt.

The above lines are only a few of those we manufacture under the M. L. Brand.

For full particulars and descriptions regarding other finishing materials write our **Maple Leaf Decorative Aid Department, Toronto**.

We guarantee all Maple Leaf goods to give perfect satisfaction. **Maple Leaf Lines make good because they're made good.**

R. C. JAMIESON & CO. Limited

MONTREAL and VANCOUVER

Owning and Operating
P. D. DODS & CO., LIMITED

Established 1858

Products Varnishes and Paints.
Finishes and Enamels.

Specialties Jamieson's Durable Exterior Finish. A varnish of the very highest quality.

Jamieson's Interior Finishing. For all high class interior work.

Jamieson's "50" Flat Varnish. Imitates the rubbed effect to perfection.

Jamieson's Liquid Wax Finish. The only finish for hardwood floors.

Jamieson's Pure Prepared Paints. Highest grade paints for exterior or interior use.

Jamieson's Vitrox. High grade enamel specially designed for decorating large surfaces. Sets slowly. Flows evenly. Waterproof and does not turn yellow.

Jamieson's Velvex. The perfect flat enamel.

Jamieson's Liquid White Enamel Primer. For undercoating.

Jamieson's Creosote Shingle Stains. The most artistic and best preservative known for shingle roofs and sidings.

Jamieson's Factory White. A washable cold water paint.

High Grade Quality Their high standard of quality backed by wide experience has gained for them a justly high reputation which makes satisfaction sure whenever their use is specified.

All Purposes We are manufacturers in the largest sense of the word and have a special product for practically every known purpose.

MANY A GOOD HOUSE IS SPOILED BY FAULTY FINISHING MATERIAL
FOR HIS OWN PROTECTION EVERY ARCHITECT AND BUILDER SHOULD
KNOW ALL ABOUT JAMIESON'S VARNISHES AND PAINTS

LOWE BROTHERS LIMITED

PAINT MAKERS - VARNISH MAKERS

263-269 Sorauren Ave.

TORONTO, ONT.

Distributors:

LYON-MONKHOUSE LIMITED

Winnipeg, Man.

Distributors:

THE JOHNSON

PAINT & VARNISH CO., LTD.

Vancouver, B.C.

Products We manufacture a full and complete line of Paints, Varnishes and Enamels for every requirement of the Architect, Builder and Engineer.

Mellotone
"Soft as the Rainbow Tint"

Specialties "Mellotone" is a flat oil paint, giving as results the same soft, velvety finish as the water paints, but, unlike them, it is sanitary and washable.

Lowe Brothers
High Standard
Liquid Paint.

"High Standard" Liquid Paint has all of the qualities necessary in a paint, that is—

It works properly under the brush.

It covers or hides the surface to which it is applied.

It forms a protective film that is impervious to moisture.

It dries correctly.

It is durable, and by gradual wear leaves a good surface for repainting.

Cost and Covering Power

Lowe Brothers' "High Standard" products are sold by dealer-agents in all parts of the country at standard prices. Because of the care in the selection of materials and the special method of manufacture, these products have unusual spreading and covering power, as well as durability and excellence of wear. These qualities make them the most economical of paint and varnish products.

They are put up in full imperial measure in sealed packages only.

Specifications

We invite consultation with Architects in regard to detail specifications. We also present on application a book of specification forms, "High Standard" Paint Specifications" and other publications for Builders and Engineers in the interest of satisfactory paint work—"Hints to Architects," "Paint and Painting," "Common Sense about Interiors" and "Homes Attractive."

BENJAMIN MOORE & CO. LIMITED

Lloyd Street

TORONTO - ONT.

NEW YORK

CHICAGO

CLEVELAND

CARTERET, N. J.



Pennsylvania Terminal, New York.

Our Products used throughout

McKim, Meade & White, Architects.

Products Manufacturers and grinders of colors in Oil, Japan, Distemper, Paints ready for use, for House, Floor, Barn, Roof, Carriage, Wagon, and Machine. Enamel, etc., Stains, Varnish, Oil. Shingle Stains, Rex Lax Wax Finish.

Wall finish—Muresco, Paqua, Building White, Decorine, White Zinc, White Lead, Liquid and Paste Fillers, Varnishes, Dryers and Japans.

General We manufacture a large number of Paints, Colors, Varnishes and Finishing materials, which it would be as useless as it is impossible to mention. The list of our manufactures under the heading products, partly enumerate those materials which are in common use. Additional information and prices on these and any other painting material will be gladly furnished on request.

Continued on next page

BENJAMIN MOORE & COMPANY LIMITED



Goodyear Tire and Rubber Co. of Canada, Limited
Fred G. Roberts & Co., Painters

Notes on some of our Special Lines

MURESCO

for wall and ceiling decoration in White and Tints. A material which has been on the market since 1893, and which is being used successfully by the leading

painters and decorators throughout the United States and Canada.

The very best ingredients of our own make and the very best Glue are its chief elements. The different articles added in the course of manufacture are mainly to control its perfect drying and lapping. All ingredients, as well as the completed product, are tested daily by practical men before the Muresco is sent out of our factory.

It is made in White, sixteen Tints, and sixteen Colors, thus making it economical to work, much time being saved in matching Tints and Colors.

One pound of Muresco covers fifty square feet, one coat, on hard surface.

Any desired shade can be obtained by mixing "Muresco" tints, Muresco Fresco colors and white.

Continued on next page



Central Y.M.C.A. Building, Toronto

Burke, Horwood & White, Architects

Fred. G. Roberts & Co., Painters

"ANYTHING IN THE PAINT LINE"

Damp Proofing

For brick walls before the application of plaster for cellar and basement walls; outside of foundations below grade and wherever walls are exposed to dampness.

Concrete Floor Coating

Made expressly for cement and concrete floors. Dries quickly, forming a coating of exceptional wear, renders powdering of the surface impossible, and prevent absorption of moisture oils, and impurities. Make a surface more agreeable to walk on than pure cement.

Nuwite

A superior under-coating for all enamel work—will not turn yellow. It is a flat white paint in paste form. Manufactured from non-poisonous and durable pigments, can also be used for interior flat work with the very best results.



Estimates, Etc.

We publish a large number of booklets descriptive of our various lines. These will be mailed free on request.

Where desired by Architects we will prepare, properly worded, safe and reasonable specifications.

We are also able to furnish estimates of cost, free, on the painting of almost any structure.

Continued on next page

BENJAMIN MOORE & COMPANY LIMITED



Burke, Horwood & White, Architects

Ryrie Building, Toronto

Fred. G. Roberts & Co., Painters



The Practical Paint for all Interior Painting, Sani-Flat without doubt the most remarkable product in the paint line and has met with unprecedented success wherever introduced.

Sanitary and Washable

Sani-Flat is a sanitary paint, drying with a beautiful soft flat finish, and having the washable and durable properties of an oil paint. It is especially recommended for walls, woodwork, steel ceilings, radiators, etc.

White Enamel

The easy working, perfect flowing, great covering capacity white enamel. It sets slowly, shows no laps, and makes a beautiful permanent finish. Water does not affect it.



THE OLDER IT GROWS THE WHITER IT BECOMES

“POWDRPAINT”

THE POWDRPAINT CO.

126 King Street - - - - Toronto

“Powdr-paint” is composed of the best Paint pigments combined with cementing and waterproofing compounds by a special process and sold in the form of a dry powder.

Durable “Powdrpaint” is the cement principle applied to paint. It is strictly high grade paint being adhesive like oil paint and when applied, it sets in a few hours so that rain, snow, or sleet does not effect it. It is not a kalsomine or a whitewash and is intended for any inside or outside use where durability, economy and great fire resisting qualities are desired.

Economi-cal “Powdrpaint” is seventy-five per cent. cheaper than lead paints. Five pounds of this powder mixed in water makes a large gallon, which has a covering capacity of about one and one-third gallons of oil paint.

Waterproof “Powdrpaint” is the ideal article for cement block buildings, all concrete surfaces, stone, brick, stucco, or plastered walls. It fills the pores, excludes moisture and makes a permanent hard waterproof finish that wears like iron. The colors are absolutely lime and cement proof and will not fade.

“POWDRPAINT”

THE POWDRPAINT CO.

126 King Street - - - - Toronto

Fireproof “Powdrpaint” is entirely mineral in nature, is not subject to the action of heat and is, therefore, a great fire retardant. For this reason it is particularly valuable in painting the interior and exterior of factory buildings, warehouses, etc. It affords almost absolute protection against fire from the burning adjoining buildings, etc. This has been so well proven that insurance companies are reducing rates where “Powdrpaint” is used.

Weather-proof “Powdrpaint” will resist, rain, sun, frost or any variations of temperature or climate and is not subject to chemical change through the action of gases, acids, etc. For this reason it is largely used around acid plants and digester rooms of paper and pulp mills where white lead, because of its unstable chemical composition and its inability to withstand sulphurous gases of all kinds, is useless.

Sanitary The Inside White “Powdrpaint” is especially intended for coating large interior surfaces such as the insides of Warehouses, Breweries, Factories, Light Shafts, Dark Stairways, etc. In fact, any place it is desired to increase the **Light**, perfect the **Sanitation** and securing Protection from **Fire**.

Architects and Contractors Specify and use “Powdrpaint” for its Fire-weather, water-proofing and sanitary qualities.

R.I.W. DAMP RESISTING PAINT CO.

(Toch Bros., New York, Est. 1848)

Canadian Factory:
OAKVILLE, ONT.

Toronto Office:
202 MAIL BUILDING, TORONTO

CANADIAN DISTRIBUTORS:

Black Building Supply Co., Ltd.
Toronto

Dartnell Limited
Montreal

Canadian Equipment & Supply Co., Ltd.
Calgary Edmonton

Western Paint Co.,
Winnipeg

Boltby, Johnston Co., Ltd.,
Vancouver

"R. I. W."
REMEMBER IT'S WATERPROOF
R. I. W.

Types
R. I. W.
No. 232

A non-saponifiable bituminous compound similar to a liquid, used on the inner surface of exterior brick or terra-cotta walls, on which plaster can be applied, rendering them vermin, moisture, and stain-proof.

R. I. W.
No. 110

For backing marble, granite, limestone, etc., to prevent staining and exclude dampness, preventing chemical action between the cement and stone.

R. I. W.
Marine
Cement

For damp-proofing exterior of foundation walls below grade level for waterproofing between boat decks and between floors of railway cars, etc.

Liquid
"Konkerit"
(Patented)

A cement paint ready for use for application to the exterior of brick, stone, cement or concrete walls above grade level making them damp-proof as well as giving a uniform appearance. It can be used for interior decorating purposes where plaster is omitted, being made in white and the five standard shades.

Cement Fill-
er and Floor
Paint
(Patented)

An organic resin of which we were the discoverers, that when applied to cement floors forms a combination such that it makes cement floors free from the injurious cement dust. Water proof and oil proof.

Service

We shall be glad to furnish detailed information of any of the above and other materials in the same line, and our experts and advisory services are at the command of the trade.

SANDERSON PEARCY & CO. LIMITED

61, 63 and 65 Adelaide Street West

TORONTO

I F
N I
T N
E I
R S
I H
O E
R S



E F
X I
T N
E I
R S
I H
O E
R S

THE HOUSE FOR QUALITY AND PROMPT SERVICE

Specialties **PEARCY'S PURE PREPARED PAINTS.**

"The oldest and most reliable."

PEARCY'S VARNISH STAINS.

Colored Varnishes for woodwork and furniture. Stains and varnishes in one operation.

PEARCY'S CREOSOTE SHINGLE STAINS.

For beautifying and preserving Shingles and Rough Woodwork. Manufactured of finest materials and will give lasting results.

GOHEEN'S CARBONIZING COATING.

Universally recognized as being in every way the best preservative of iron and steel construction.

GOHEEN'S GALVANUM PAINT.

The only paint made that will adhere for years to galvanized iron.

LIQUID GRANITE.

This is the most satisfactory Floor Varnish made, combining the three principal requisites of a perfect floor finish—elasticity, durability and appearance. We handle the line of Berry Bros. Celebrated Varnishes and finishes.

LUXEBERRY WOOD FINISH.

"Interior Varnish of unexcelled quality."—Berry Bros.

ALABASTINE.

"The Sanitary Wall Coating." A dry powder mixed in cold water, 21 attractive shades.

W. B. BATE & COMPANY

171 KING STREET WEST

TORONTO

HALLS DISTEMPER

(The Sanitary Water Paint)

Advantages Disinfectant. Washable.

Durable. Economical.

Fireproof and Artistic.

Will not fade. Will not peel off.

Will stand the effect of lime.

Seventy shades all one price.

Made in two qualities for interior or exterior use on any surface.

The labor when using this Distemper is 40% less than when oil paint is applied.

One hundred weight covers double the surface of one hundred weight of pure Lead and saves Oil and Turpentine.

“EMDECA”

Enamelled Metallic Wall Tile

The Original and only Enamelled Metal Decoration that has stood the test of time.

In use since 1885.

To try once means to use it always.

It has been honored with seventeen gold medals.

Germproof. Absolutely washable.

Nonabsorbant. Artistic.

Cheaper and better than tiles.

Lasts practically forever.

For Bathrooms, Lavatories, Kitchens, Hospitals, Butcher and Dairy Shops, etc.

Used in the Hospitals, Railroad Coaches and Steamboats of the British Isles.



RONUK LIMITED

PORTSLADE, ENGLAND

Specialists in the Manufacture of Floor and Furniture Polish, and in the Treatment of Floors and Woodwork.

Show-Room with Ronuk-Treated Floors, Panelling and Specimen Finishes
53 YONGE STREET, TORONTO—Head Office for Canada

Depot: 91-93 Youville Sq., Montreal

Product	Ronuk Floor Polish is a wax finish of unique composition; the purest ingredients only are used. Antiseptic materials are employed which possess the same germicidal properties as common disinfectants, but are without their disagreeable characters of smell and corrosive qualities. Ronuk is therefore particularly suitable for use in hospitals and public institutions. Ronuk has proved its superiority in England for the past 20 years as the best finish for floors and interior woodwork; it is fast gaining favor with Canadian Institutions, and is in use in a large number of Hospitals, Institutions, Clubs, Banks, Offices, etc., a list of which will be supplied on application.
Resists Germs and Diminishes Dust	Ronuk sinks in and fills the pores of the wood, instead of simply covering the surface, and forms a hard, bright, transparent finish, that will not "pick" or "roll." Ronuk Floor Polish, as well as filling up all crevices where germs and dust might accumulate, forms a surface so smooth and hard as to afford them no harbour.
For any Wood	Ronuk can be applied to any hard or soft wood, and, in conjunction with Ronuk Special Stains, an infinite variety of beautiful effects can be produced. A Ronuk finish on any woodwork is silky and beautiful, and can be adapted to suit any taste.
Linoleum, Cork Tiling	Ronuk is an excellent dressing and preservative for Linoleum, Cork Carpet and Tiles, Patent Flooring, etc.
Saves Labour and Material	To secure the best results, Ronuk should be applied sparingly, thus making it a very economical finish. One dressing only is sufficient, and it is kept in perfect condition by the application of a very little Ronuk from time to time. Ronuk floors never require scrubbing, or cleaning down with Turps or Benzine.
How To Apply	Soft Woods —A preliminary treatment with Ronuk Special Staining not only beautifies the wood, but prepares the surface to receive the Ronuk Floor Polish properly. Ronuk stains do not bleach or come away.
Paste Filler Unnecessary	Hard Woods need a preliminary dressing with Ronuk Oil Stopping (Filler) or combined Filler and Stain, which fills up the pores of the wood and enriches its appearance. The floor should be absolutely clean and dry. The Stopping or Stain is then applied and thoroughly rubbed in with a circular motion, wiped dry on the surface, and allowed to stand for 24 hours. Ronuk is then well rubbed into the wood and <i>allowed to dry for two hours</i> ; it should then be brushed thoroughly into the wood with a weighted floor brush, and finally polished with a cloth under the weighted brush, and finished with a second clean cloth or flannel in the same way. Ronuk does not dry too rapidly when applied. It contains no petroleum, which evaporates too quickly to carry a dressing right into the flooring. Ronuk gets right into the wood and preserves and feeds it.
Maintenance	Floors treated with Ronuk Floor Polish should have a very little Liquid Ronuk applied, brushed in and rubbed with a flannel from time to time as required to maintain a bright, clean surface.
Lasting Qualities	Floors treated with Ronuk will wear for years, improving from year to year.
Contract Work	Ronuk Limited will undertake or arrange with contractors to undertake the treatment of Floors, Panelling, Interior Woodwork, Linoleum, etc., following the methods above specified.

THE NORTHEASTERN COMPANY

Manufacturers of

LETTENEY

(Reg. Trade Mark)

WOOD PRESERVATIVE

6 Beacon Street, - - Boston, -Mass., U.S.A.

Product Letteney Wood Preservative.

Description "Letteney" is a liquid compound manufactured from by-products of pure bituminous coal-tar, distills only at high temperatures, and contains no light volatile matter. It is not a surface coating but penetrates the wood and remains there permanently. It is a powerful antiseptic, prevents decay and prolongs the life of the wood in a most amazing manner. Not soluble in water and will not wash out. It maintains the tough fibrous condition of the wood and prevents splitting and splintering.

The permanent color of "Letteney" is a dark red brown, producing a very artistic stain for fences, trellises, half timber work, etc.

Uses "Letteney" should be used on all woodwork that comes in, on or near the ground, in damp or poorly ventilated locations for bridges, piers, wharves, railroad ties, telephone and telegraph poles, cross-arms, shingles, fence posts and piles; flooring of freight houses, mills, warehouses, stables; mine timbers and conduits; nailing strips in concrete, etc.

Method of application "Letteney" is applied to wood by the brush or open tank methods. Too much importance cannot be placed on having the wood as dry and well seasoned as possible, and posts, poles, ties, piles, etc., should have all bark removed before being treated.

Experience There are forty-six years of successful manufacturing packed into every package of "Letteney." Forty-six years of knowing how to preserve wood from decay.

Reference Letteney Wood Preservative has shown its value in preserving the timbers of the following old structures, among many others:

Meridian Street Bridge, East Boston, Mass., 1867.

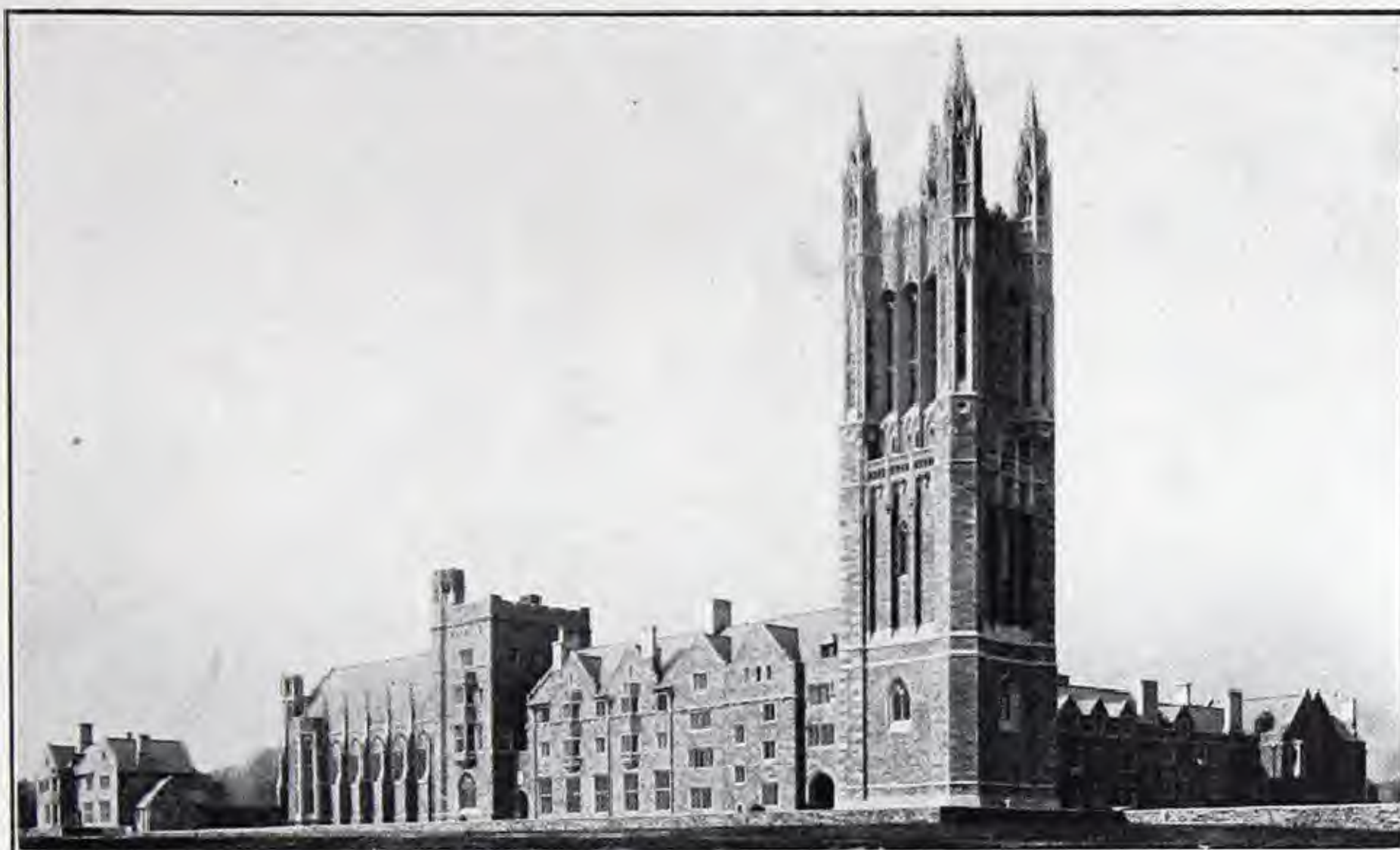
Dover Street Bridge, Boston, Mass., 1876.

Chelsea Bridges, Boston, Mass., 1877.

Malden Bridge, Charlestown, Mass., 1875.

Service Letteney Wood Preservative is put up, ready for use, in barrels cans of five and ten gallons. Prompt shipments made to all parts of Canada and United States.

THE NORTHEASTERN COMPANY



Graduate School, Princetown, N.J. Wooden Floor Screeds Treated with "Lettenev."
Cram, Goodhue & Ferguson, Architects



West Shore Railway. Pier 5. Weehawken, N.J.
Timbers and Planking Treated with "Lettenev."
N. Y. C. & H. R. R. R. Engineers



Boston & Maine RR. Highbury Bridge, Somerville, Mass.
Timbers and Planking Treated with "Lettenev."

FRED G. ROBERTS & CO.

DECORATORS

106 WELLS ST. - TORONTO

Phone Hillcrest 1493

A. F. Hetherington, Manager

After business hours - Hillcrest 318

Service We are prepared to execute all kinds of interior and exterior Painting, Decorating, Graining, Tinting, and Glazing.

Facilities All interested in building in general—
NOTE—That this firm can handle contracts regardless of their size.

Estimates Our thorough knowledge and long experience enables us to advance accurate estimates to Architects, Builders, or owners upon request.

References The following is a list of Buildings for which we have successfully and satisfactorily completed the painting, decorating and glazing.

C.P.R. Building,
King and Yonge

Canadian Foresters Hall,
22 College Street

Process & Press Buildings,
C.N. Exhibition Grounds

Darling Building,
Spadina Ave.

Bell Telephone Co.
College Exchange

Central and West End Y.M.C.A.
W.C.T.U. Gerrard St. E.

Ryrie Bros., new Bldg.
and many other Public Buildings and Churches.

Allen Building, Simcoe St.

FLOOR CONSTRUCTION

SPECIFICATIONS FOR TERRA COTTA GENERAL.

Floor construction will be of the type known as the combination hollow tile and concrete floor slab construction, consisting generally of (4 inch) reinforced concrete beams spaced 16 inches on centres, with hollow tile blocks between, all to have at least 4 inch bearing on walls, or more, according to spans.

CONCRETE.

Refer to Chapters on Concrete Construction.

TILE.

Depth of tile filler blocks will be regulated by span and load to be carried, and will be of size indicated on the plans. All blocks will be wet before concrete is placed so as to insure a good bond with the concrete.

CENTRES.

Centres must be of such size as to insure their not deflecting under the weight of the wet concrete, and must be provided in such quantity as to insure speedy work. Care must be taken not to remove the centres before the concrete is hard, and under long spans a centre line of supports must be maintained as long as necessary to insure perfect setting after the concrete has been poured. In cold weather the centres must be left in place until directed by the architect to remove them.

STEEL BEAMS.

When steel beams and hollow tile arches are used, space must be left to prepare a proper foundation for setting surface tile or wooden floor. The rough coat or concrete sub-floor is to be laid by the hollow tile contractor. This cover should always conform to the requirements for a solid tile floor. Cinders, lime or inferior material will not be allowed in sub-floor. Tops of steel beams should be three inches below the finished floor line to prevent floors from showing lines of beams.

Where wooden floors are to be laid, the carpenter will place by nailing strips, inches on centres. Same to be tarred, laid level and concrete sub-base brought up flush and well tamped.

CEMENT FLOORS.

Aggregate.

The cement used shall be first-class Portland cement, and shall pass the standards of the Canadian Society of Civil Engineers. Sand for the top finish to be clean and sharp, and such that it will remain on a number 30 sieve, and pass a number 20 sieve. Broken stone for the top surface shall pass a $\frac{1}{2}$ inch screen and be retained on a number 20 sieve.

All sand and stone or gravel must be free from dust. Sand for the base shall be clean and sharp. The aggregate for the base to be broken stone or gravel, and such as to pass a 2-inch ring.

The subgrade of inches of (cinders), and the base, to be thoroughly tamped. The base must be inches thick. Concrete for the base must be thoroughly mixed with just sufficient water so that tamping is required to bring moisture to the surface. If old concrete forms a base it should be thoroughly cleaned, roughened, and soaked with water; and before scrubbing the base with grout the excess of water should be removed.

Finish.

The finish shall be mixed one part cement, one part sand and one part broken stone to pass a $\frac{1}{2}$ -inch screen, and shall be troweled on with as much pressure as possible to insure a good bond. When the desired thickness of finish has been placed, it should be screened and floated to a true surface. Between time of initial and final set it is to be finished with steel trowel by skilled workmen, and worked to a final surface. No dryer will be allowed, and no water is to be added to make the material work easily.

WOOD FLOORS.

Tar Concrete Base.

Sleepers for timber floor to be 3 inches by 3 inches by 18 inches centres. Subgrade to be thoroughly tamped and rolled to level, $4\frac{1}{2}$ inches below top of sleepers. Then sleepers to be placed in position on stakes driven in subgrade and brought to the level before laying tar concrete base.

The tar concrete base to be not less than $4\frac{1}{2}$ inches.

First layer to be 3 inches thick, of coarse screened gravel thoroughly mixed with tar and tamped to a hard level surface. Second layer to be $1\frac{1}{2}$ inches thick, of sand and coal tar pitch, one part pitch to three parts sand. The sand, gravel and tar to be heated to between 200 and 300 degrees Fahr. during mixing, thoroughly mixed and tamped.

Sub-floor.

The sub-floor planks to be sound hemlock or pine, 2 inches thick, planed and of even thickness. The floor plank to be toe-nailed with 4-inch wire nails.

Finish.

Finishing floor to be maple (or beech) of inch thickness, thoroughly air and kiln dried, and not over inches wide, matched and ploughed on under side. Finish to be laid at right angles to sub-floor.

No flooring is to be laid until tar concrete base and plank sub-floor are perfectly dry.

Floor to be finished smooth on completion.

CORK AND RUBBER TILING.**GENERAL.**

Floors, stair treads, base or wainscot, may be covered with cork or rubber tile. Specify parts of building to be so covered and give thickness of tile, color, height of bases and wainscoting, whether coved base or plain, color strip wanted and width. When stair treads are of cork or rubber tile, specify kind of nosing as moulded, plain, brass or cast iron, etc. Whether or not coved riser, show on details.

CORK TILE.

To be (manufacturer's name and quality) or equal. Made of clear granulated cork (with or without binding material), thoroughly baked and finished in a workmanlike manner. To be set in elastic waterproof cement so as to make a continuous and waterproof surface.

Before laying the contractor is to examine all floors and backing, and if such are not in suitable condition, he must report so to the architect and have the defects rectified before proceeding. Specify kind, quality, etc., of building paper to be laid under tiling if such is desired.

RUBBER TILE.

Specify maker, brand, quality, colors, sizes and thickness, method of fastening, etc. Mention parts of building to be covered, as stairs, floors, bases, etc. (Metal nosings are more satisfactory on the whole than rubber, which, due to expansion of the tile, are liable to become loose on the stair.)

COMPOSITION FLOORING.**GENERAL.**

There are many compositions on the market which make very satisfactory floors. They are laid as tile or troweled on. The foundation or sub-floor generally being an ordinary wood floor or concrete. No general specification can be written covering such flooring, as the compositions are usually trade secrets, and the method of laying and kind of sub-floor required are determined by the maker. Generally it is sufficient for the architect to assure himself that the floor in question is as represented, and obtain from the manufacturer a statement of the conditions under which he can guarantee a satisfactory floor.

MARBLE.

Specifications for laying marble floors will be found under the general heading "Stone Masonry."

TERRAZZO.**MARBLE.**

Use Italian marble where possible. All marble to be hard, good color and not too crystalline. Size of pieces from one-eighth to one-half inch.

CEMENT.

Use Portland cement of approved tests. White cement where required.

PROPORTION.

Two parts of marble chips to one of cement. With well graded chips, five of marble to two of cement.

SUB-BASE.

When the foundation floor is concrete the terrazzo sub-base to be at least one inch thick, composed of one part cement and two parts clean, sharp sand. When the foundation is a wooden floor, the terrazzo sub-base to be at least three inches thick. When the wooden floor is above a plastered ceiling, the floor is to be covered with waterproof building paper before the sub-base is laid.

LAYING.

Before sub-base has hardened lay not less than one-half inch layer of terrazzo, sprinkle colored marble as required, to show 80 per cent. of the area of finished floor, and roll until surface is fully grouted.

JOINTS.

Terrazzo flooring should only be laid in large sheets on solid concrete foundation. On wood underfloor it should be divided into squares of not over ten feet a side, with paper jointing. Where possible joint should be formed of marble mosaic cubes or different colored terrazzo. All doorways between rooms should be jointed with marble mosaic or terrazzo.

POLISHING.

Terrazzo should be ground down either by hand or with machine until required percentage of marble shows. Then grouted with stiff paste of neat cement to fill rough places and repolished with FF carborundum stones. This should leave a glass finish.

FINISH.

All terrazzo floors should be treated with a wax to prevent absorption and staining; white cement floors especially. This should be applied as directed by the manufacturers and the surface waxed with ordinary floor wax.

CARE.

Terrazzo floors untreated should be cleaned with marble dust or Dutch Cleanser. Waxed floors need only soap and water. Untreated floors will absorb grease and paint stains which cannot be removed.

ASPHALT FLOORS.**PREPARATION OF FLOOR BASE.**

Proper slope for drainage shall be provided in the floor base, or can be supplied by a filling made of asphalt and sand. The surface of the concrete or wood shall be clean and as dry as possible, and shall be covered with 1-ply of asphalt felt or 2-ply building paper.

Materials.

The floor is to be covered with asphalt manufactured by _____, or equal. The asphalt blocks as furnished shall be

plainly marked with the name of the brand and shall be of such size and weight as shall be convenient for handling.

The flux shall be (99.5 per cent.) pure bitumen. It shall be elastic and of the same composition and origin as the asphalt in the blocks. No mixing or compounding of the flux on the site of the work shall be permitted.

The mineral aggregate shall be a clean, well-graded material, which contains no particles appreciably larger than would pass through a $\frac{1}{4}$ -inch screen and from which all the fine sand or dust has been removed. It shall be either washed torpedo gravel, washed limestone screenings, or washed granite screenings.

Mixing and Heating.

To the blocks there shall be added from four to six per cent. of flux and from sixty to eighty per cent. of mineral aggregate. The blocks shall be broken into small pieces and thoroughly melted and mixed with the flux. The mineral aggregate shall then be added and thoroughly mixed by the use of iron stirring rods, and the temperature of the mixture brought to (450 deg. F.). The material shall then be removed from the kettle and taken to the work in buckets. Care shall be taken to keep the material from burning on the bottom of the kettle by constant stirring.

Application.

The asphalt shall be spread to the required thickness by the use of wood spreaders and

floats, the thickness being gauged by wood strips held in position. The floor shall be laid in widths convenient for proper spreading and rubbing—usually 5 or 6 feet. Floor 1 inch thick shall be laid in 1-ply. If thicker than 1 inch it shall be laid in 2-ply with lapped joints. Care shall be taken to keep the first ply and all joints clean and free from dust or moisture. All joints shall be painted with hot flux. In making joints, hot asphalt shall be laid over the cold edge of the joint and allowed to remain until the same is heated and softened. The surplus material shall then be removed and the joints made perfectly compact and tight by sufficient rubbing.

The finished surface shall first be sprinkled and rubbed with fine sharp sand, which shall be swept off while the material is still hot. The surface shall then be dusted with Portland cement, free from lumps, and shall be rubbed with sufficient pressure to eliminate all voids and blowholes, making a homogeneous mass throughout.

Fillet.

A fillet of (suitable height) shall be placed around all columns and walls after same have been painted with hot flux.

Guarantee.

The contractor shall guarantee the floor for a period of (5) years to be free from defects of either material or workmanship.

TILE FLOORING.—Specifications from the Tile Manufacturers' Association, see "Marble and Tile."

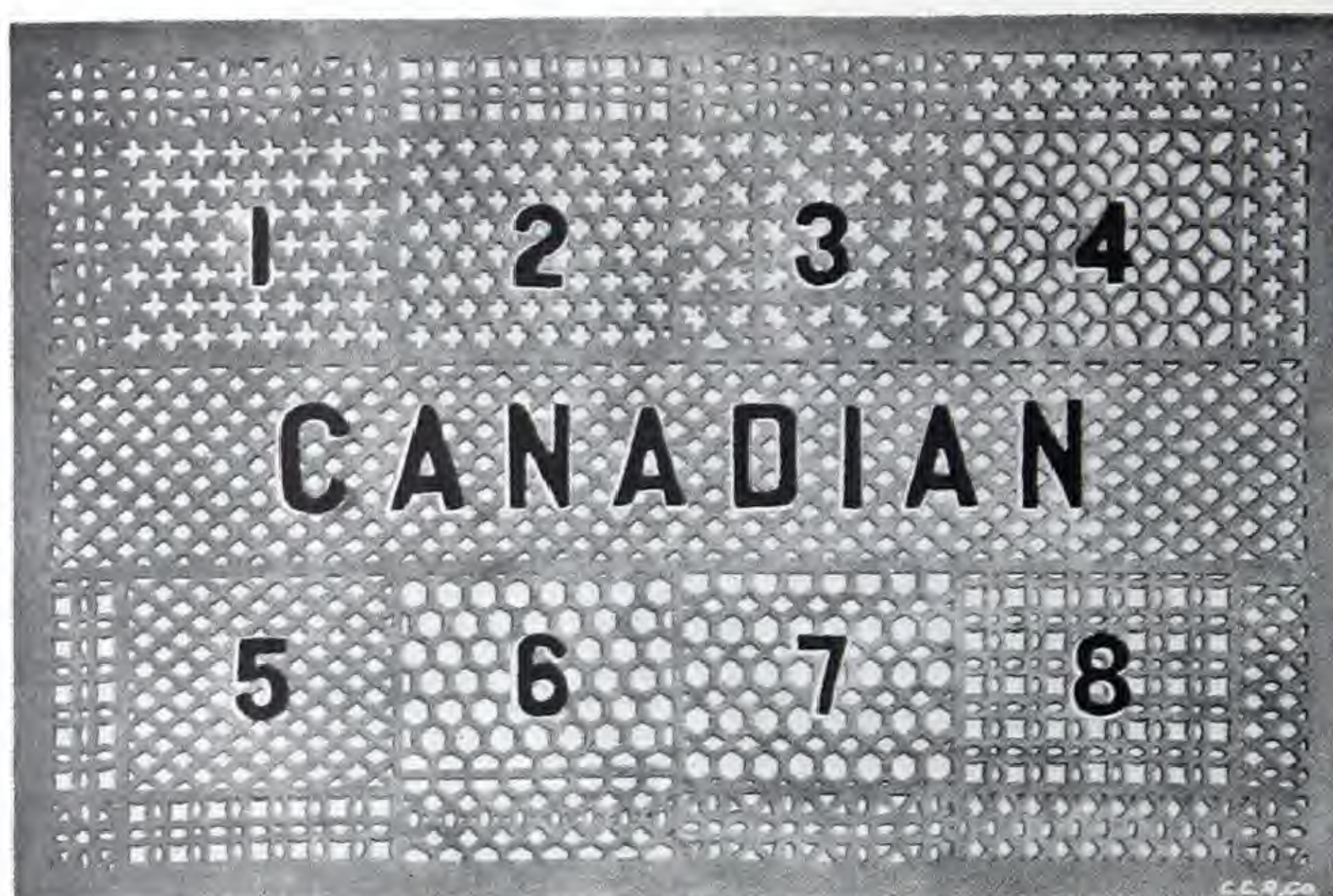
CANADIAN CONSOLIDATED RUBBER CO., LIMITED

MONTREAL, P.Q.

28 Branches throughout Canada

Product Rubber Perforated Mats are noiseless, attractive, sanitary, durable, and afford an excellent foothold. They will not scratch woodwork or tiling and do not get out of place like metal mats.

Design and Grades We manufacture Perforated mats in Standard Designs and in three grades, "Special," "Canadian," and "Montreal," made in thicknesses of $\frac{3}{16}$ in. and upwards.



Lettering The insertion of black, white, or red letters, monograms, trade-marks, facsimile signatures, etc., produces a most attractive effect, and we will submit designs whenever it is desired.

If the lettering is left to our judgment as to size and style, we generally furnish a plain white letter, size in proportion to mat.

A slight additional charge is made for the letters.

When Ordering We prefer to have a sketch or heavy paper pattern, giving the exact size and shape wanted, as well as a mark showing the top of the mat, and, when letters are ordered, their position should be clearly indicated. Mats larger than five feet square should be made in sections to facilitate handling, in order to prevent the mat from being injured when moved.

In ordering sectional mats kindly indicate if the border is to run around each section or only around the mat. In the latter case, the sections where they run together are made with a narrow straight border, called a "sectional border."

Information For other information in our line and estimates write us and we will promptly attend to your needs.

THE MARBLELOID COMPANY

Manufacturers of

MARBLELOID FIRE-PROOF FLOORING

Also General Sales Agent for the best European Cork Tiling made—A product of superior merit.

Main Office: Broadway & 34th Street, New York, N.Y.

Branch Offices at Pittsburgh, Pa., Cincinnati, O., Toledo, O., Washington, D.C., and Atlanta, Ga.

Canadian Agents: Archibald and Brotherhood, 275 Craig St. W., Montreal,

Description Marbleloid is a standardized, permanent, light-weight, fire-proof and resilient covering for floors, coved sanitary base, wainscot, trim, treads, etc. It is laid plastic, usually one-half inch thick, and sets in a few hours into a seamless, durable and resilient body possessing a fine-grained, smooth surface.



The Marbleloid Flooring thus forms a hermetic seal offering neither joints nor crevices for the accumulation of germs, dirt or moisture. Its jointless character and remarkable comparative freedom from cracks due to uneven settlement, warping or vibration of building give it unusual sanitary value. It is easily kept clean; it is quiet under the tread; owing to its elasticity, it possesses high resistance to abrasion; it is not slippery; it is water-proof; owing to its plasticity it is not fatiguing; it is a non-conductor of heat and, therefore, never cold; it has great crushing and structural strength and does not contract nor expand to any appreciable degree. Marbleloid is unaffected by heat, moisture or any other climate conditions.

Universal Use

When it was first introduced over ten years ago, Marbleloid was offered and adopted largely as a hospital or institutional flooring, the main consideration being given to its sanitary qualities. Later its many other desirable flooring features claimed recognition with the result that to-day it is specified and used by our leading architects for floorings of the most diversified character. Over three thousand Marbleloid installations of large area have been made in the plants and factories of many of our leading corporations, in many of the best known and loftiest office buildings, in schools, hospitals, Y.M.C.A. buildings, churches, hotels, railroad stations, libraries, theatres, banks, steamships, amusement halls, public buildings, stores, restaurants, cafes, power houses, garages, and in residences and apartment houses of the highest type.

Cost

Marbleloid is a permanent flooring. In the residence, it will last a life time; in the factory it will stand for years under the most severe conditions. Because of its great cohesive and resilient properties, it will out-wear any other kind of flooring.

The cost per square foot varies from 25 cents to 50 cents depending upon the nature of the work, area, location, etc.

Guarantee

The Marbleloid Company guarantees the quality of its material and all work performed by its own workmen, and will repair free of cost all defects due to the use of improper material or workmanship.

Samples, References, etc.

Samples, color-card or estimates together with full literature and references will gladly be mailed upon request.

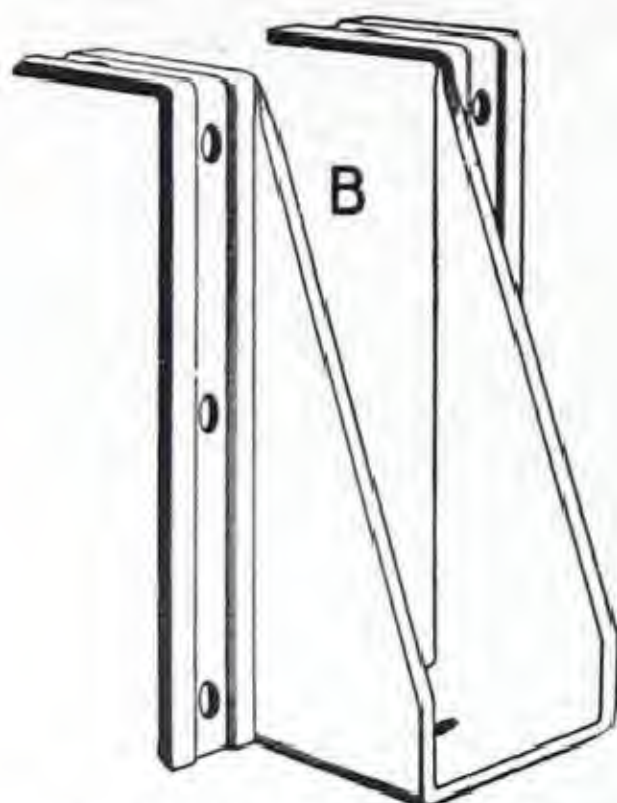
THE VAN DORN IRON WORKS COMPANY

CLEVELAND, - OHIO

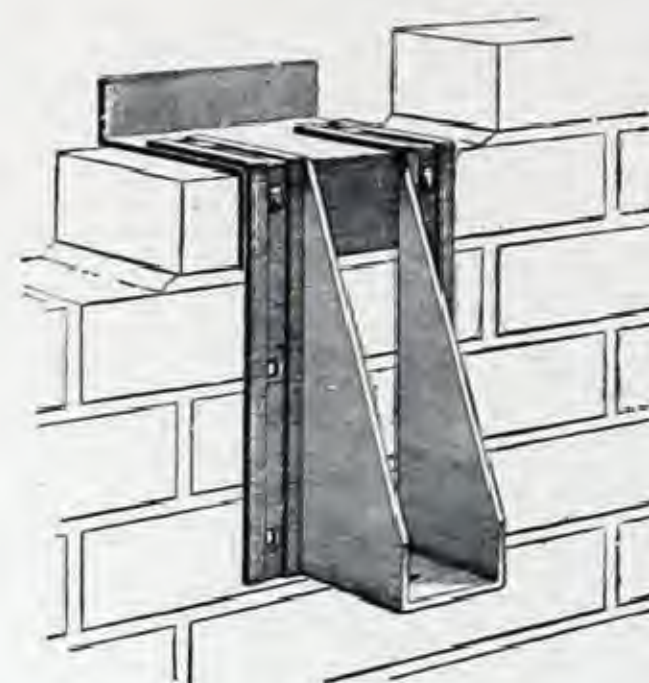
Joist Hanger Department

Product Quality

Joist Hangers, Beam Hangers, Steel Post Caps, and Bases. We guarantee all our goods to be first class in every respect and will replace them if found to be defective.



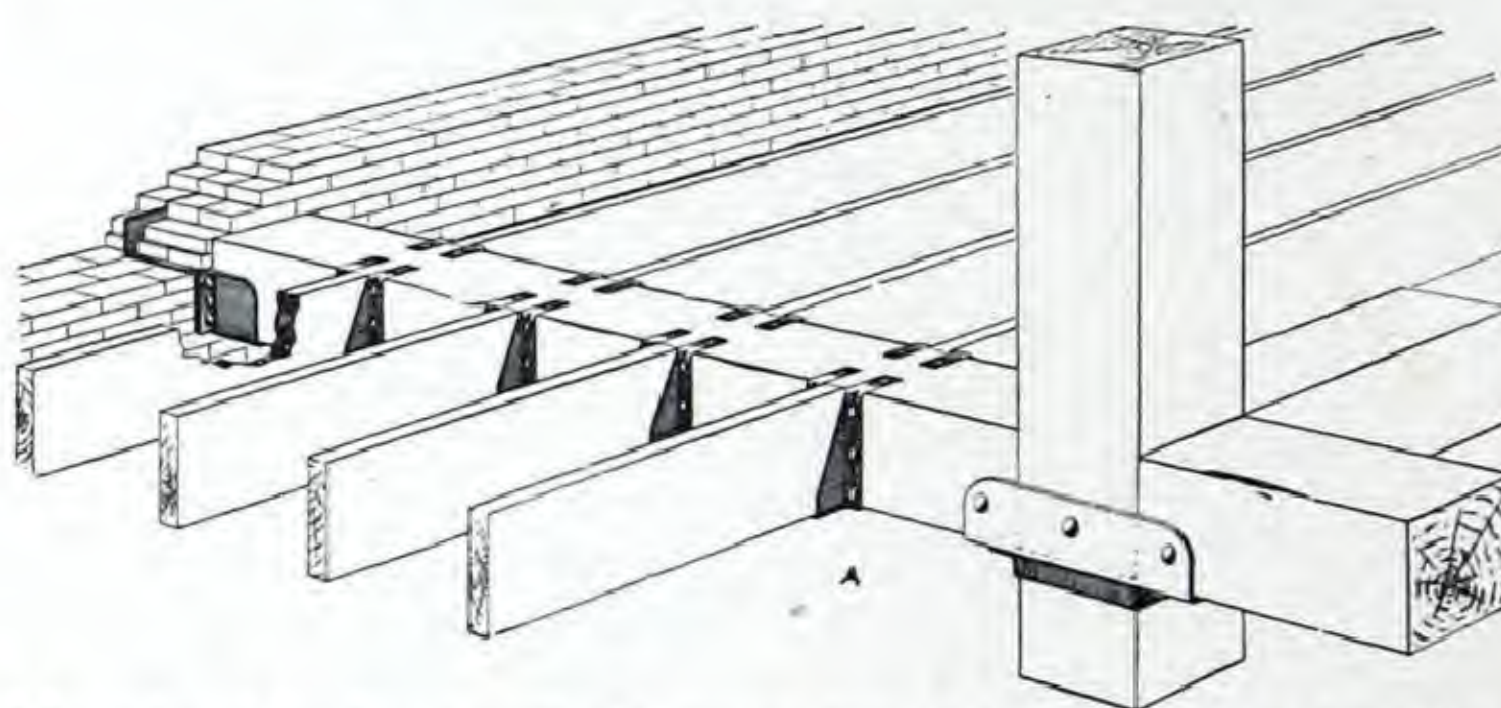
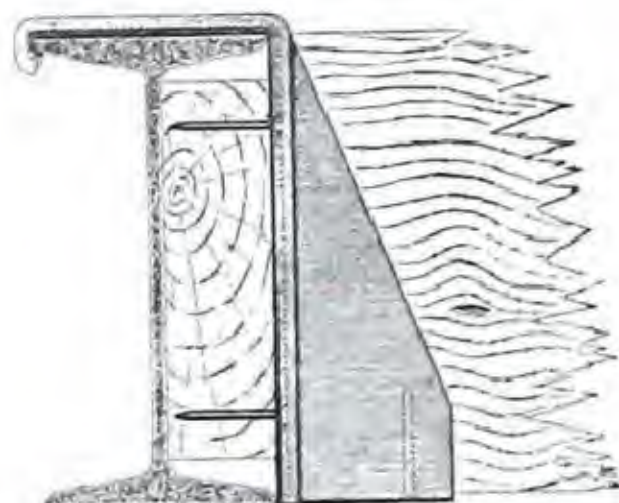
No. 1, Our Regular Hanger



No. 4 or Wall Hanger

Facilities

We have installed additional equipment in our factory in the way of electric welding machines, the purpose of this installation being to facilitate the lowering of production cost; and, are, therefore, in a position to quote you extremely low prices on our line.



No. 7 or Beam Hanger. Plan of framing showing regular Hangers, Wall Hangers and Three Post Caps

Styles

Our Hangers are made of the best of steel obtainable. We own the rolls on which these bars are made, each and every bar being subjected to surface and analytical inspection. Therefore, there is no question as to the tensile strength.

In the manufacture of our wall hanger as shown we use our No. 1 Hanger with plate (Fig. 1). The plate is riveted to the Hanger with four rivets making the hanger very rigid and laying on the brick wall without breaking the joint.

In case of fire when the interior is burned out it leaves the walls intact without bulging and the joist can be replaced without touching the hanger.

THE VAN DORN IRON WORKS COMPANY

Hanger for Steel Beam We manufacture as herewith shown a special hanger which is made to connect to a steel I Beam girder.

This hanger is made by rivetting a steel plate, made to fit over flange of the beam, riveted to our Regular Hanger.

The cut shows a wood block placed between the hanger and the beam but this is not absolutely necessary as the hanger is made to the exact size.

This method is much superior, more effective, safer and quicker than the old method of cutting the joists.



Steel Post Bases and Caps Progressive Architects agree that Joist Hangers, Post Caps and Bases are the practical material to be employed in mill constructed buildings.

Our material is stronger, more easily applied and considering all phases, cheaper than any other.

Other styles and all sizes furnished.

Test In this test 3 x 14 oak joists 11 feet long were used, suspended in Van Dorn Medium Hangers fastened to oak headers. These joists were loaded with 50,000 pounds of pig iron, **without the least observable effect on the hangers.** The load of 50,000 pounds corresponds to 1709 pounds per square foot on joist space 16 in. on centre.

Send for Catalog No. 80 for full information.

ROBINSON BROS. CORK COMPANY, LIMITED

Head Office:

803 LUMSDEN BUILDING, TORONTO

Works:

PORT COLBORNE, ONT.

Product Cork Tiling. The finest flooring material for banks, churches, public buildings, hospitals, clubs, restaurants, billiard rooms, kitchens, bath rooms, etc.

**Manufac-
ture** Our Cork Tiling contains absolutely no other substance but pure compressed cork, baked by electricity in specially built ovens of our own design.

Supplied in slabs of any size up to 36 in. by 12 in. and in light, medium and dark colours. Standard thickness, $\frac{1}{2}$ in.

**Applica-
tion** The Floor to which it is proposed to apply the Cork Tiling, whether of wood or concrete, should be left true and smooth for its reception. Write to us for further particulars on individual cases.

Advantages Cork Tiling is non-slippery, noiseless, odourless, resilient, and durable. It is absolutely sanitary as there are no joints in which germs can be harboured. Cork being an excellent non-conductor, a floor of this kind is practically unaffected by changes in temperature.

MADE IN CANADA

HEATING AND VENTILATION

SYSTEM.

Specify the system of heating in a general way, high pressure, low pressure, vacuum, direct, indirect, or direct-indirect, basement or attic mains, one or two pipe connections to radiators, dry or wet return, etc.

Total radiation in square feet of surface. Size of units (except in large buildings, where sizes shall be as shown on plans) temperature to be maintained in zero weather.

BOILERS.

Specify maker, size, type, number, steam pressure, working and safe, capacity or approximate horse-power, heating surface, grate area, kind of grate.

Locate boiler on plan and elevation and specify kind of setting, portable or brick. Specify also flue connection, steam and water connections, thermometers, gages, damper regulators and firing tools and conditions of final boiler-test.

PUMPS.

If pump is used, specify make, type, size, fittings, foundations, location, steam and water connections. Also size and kind of receiver and base, if same is used. Lubricator and governor.

PIPING.

In addition to layout, specify drainage grade of all pipes in inches per foot run. Specify quality of pipe, weight and material, supports and insulation. All pipes should be stood on end and pounded to remove scale before putting into system. Cut pipe should be reamed to size, threading should be full and clean cut to the following minimum lengths. Specify kind and quality of pipe joint compound.

Lengths of Threading that W.I. Pipe Should Be Screwed Into Fittings.

Pipe Size Inches	Length Screwed into Fitting	Pipe Size Inches	Length Screwed into Fitting
$\frac{1}{4}$	$\frac{3}{8}$	$3\frac{1}{2}$	1
$\frac{3}{8}$	$\frac{3}{8}$	4	1
$\frac{1}{2}$	$\frac{3}{8}$	5	$1\frac{1}{8}$
$\frac{3}{4}$	$\frac{1}{2}$	6	$1\frac{1}{8}$
1	$11/16$	7	$1\frac{1}{4}$
$1\frac{1}{4}$	$\frac{5}{8}$	8	$1\frac{3}{8}$
$1\frac{1}{2}$	$\frac{5}{8}$	9	$1\frac{3}{8}$
2	$\frac{3}{4}$	10	$1\frac{1}{2}$
$2\frac{1}{2}$	$\frac{7}{8}$	12	$1\frac{1}{2}$
3	$\frac{7}{8}$		

FITTINGS.

Specify kind of fittings, whether light, standard or heavy, cast iron or malleable, flanged or screwed (in flanged fittings specify kind of gaskets), kind of bends, whether long or short radius. Eccentric fittings should be

used in all places where "pockets" are liable to form. Specify brass seated or C.I. Unions. (C. I. unions should have sheet lead gaskets, care being taken to use proper weights of lead in small sizes.)

SPECIALTIES.

Include anchors, expansion, joints, valves, steam traps, grease-traps, vent valves, reducing valves, etc.

Anchors shall be placed where shown on drawings and shall be securely fastened to supports. (Give maker, size and quality.)

Expansion joints to be located on drawings, specify kind, size and allowable movement.

Valves shall be straight way gate type in all cases unless otherwise stated. Valves should be specified whether brass, brass mounted or cast iron, rising or stationary spindle, screwed or flanged, state pressure to be carried.

For steam, return and grease traps, specify make, capacity, and locate on drawings, flanged or screwed. Whether by-passed or not.

Reducing valves, specify maker, quality, range and location, flanged or screwed fittings. Whether by-passed or not.

MAINS, RETURNS, BRANCHES, RISERS, ETC.

Branches shall be taken from top of mains by tees, suitable nipples and elbows. Risers shall be connected to branches so as to drain perfectly. When expansion joints are not used piping shall be arranged to provide for movements. Risers and branches are to be placed so as to clear all natural openings in floor, walls, etc., so as to be as much out of the way as possible. Specify number and sizes of radiator valves, or special valves. Allowance to be made at all radiators for expansion.

RADIATORS.

Specify type, floor or wall radiators, giving type, height, number of columns, number of sections and square feet of surface needed. Specify wall brackets for wall rads., type and position and air vents for all radiators. All radiators shall be clean and free of sand, scale or other dirt before leaving the factory, and connections shall be plugged before shipment.

Where coils are used, specify number and size of pipes length and minimum length of short leg, whether corner coils, harp or return bends. Specification for pipe fitting to apply to coils. Specify kind of headers.

HANGERS AND CEILING PLATES.

Wall rads. and horizontal runs of pipe shall be supported on suitable hangers or wall supports, that will permit of absolute freedom of expansion. Supports shall be

feet centre to centre. Pipe holes in concrete floors shall be thimble; holes through wooden wall or floors shall have suitable air space around the pipe, and all openings shall be covered with ornamental floor, ceiling, or wall plates.

TESTING.

Upon completion of the work embodied in this specification, the contractor, in the presence of the architect, shall make the following test:

Cold water or feed piping to be submitted to _____ pounds per square inch hydrostatic pressure.

Boiler and all live steam piping to be subjected to a steam pressure of _____ pounds, without displacing, straining, or causing any portion to leak. Exhaust steam piping or return piping to be tested to _____ pounds under similar conditions, with similar object. Pressures are to

be sustained for sufficient time to permit of careful examination of the system for split piping, imperfect fitting or fittings, leaks and defects of a structural nature due to poor workmanship. Defects, if found, to be remedied at once by contractor and test repeated until system shall be tight and free from all blemish. When this is accomplished pressures shall be lowered to the regular working condition and the system run on a bleed for such time as will secure a thorough washing out of all sediment, scale, etc., from pipes and radiators. During this run the condensation shall be allowed to waste away to the sewer through the by-pass.

Upon completion of the washing-out process, which should cover at least one week, the contractor shall adjust and put in operation all automatic appliances, which may have been removed during the preliminary tests, and leave the system in a satisfactory running condition.

VACUUM HEATING SYSTEMS

CUTTING AND EXCAVATING.

Excavating or filling necessary for the proper installation of the fan, tempering coil, motor, or engine for fan must be done by and at the expense of the contractor. Where holes or recesses must be cut in walls, floors, ceilings, or any other part of the building it must be done by a competent workman in a neat and workmanlike manner, and at the expense of the contractor.

DIMENSIONS.

Figured dimensions shall always be taken in preference to scale dimensions. Finished dimensions shall be taken from premises by heating contractor.

SCOPE OF WORK.

The work to be considered under this contract contemplates the complete installation of piping, boilers, vacuum pump, boiler feed pump, and receiver, vacuum pump governor, oil separator, pressure reducing valve, gauge board, and gauges, radiation, radiator traps, supply valves, pipes, fittings, covering, and all installing work fitting, connection of steam supply to pumps and setting of boilers ready for all installing work, fitting, connection of steam, complete installation, to make a complete working system in accordance with the true intent and meaning of the accompanying plans and specifications. Brick work to be done by the mason contractor. Any apparent discrepancy or technical omission in either these specifications of the accompanying plans, or both, will not admit of any charge over and above the contract price, and such omission or discrepancy shall be made good by the contractor, at no charge whatsoever.

BOILERS.

Contractor will furnish and set ready for bricking in _____ horizontal tubular boiler

(s) suitable for a working pressure of 100 pounds per sq. in. Boilers to be thoroughly tested to 150 pounds per sq. in. hydrostatic pressure before leaving the factory. Boilers to be well bricked in by other contractors according to blue-print and specification supplied by the manufacturer. All exposed fire surface must be of hard burned fire brick. Main return pipes where they enter the boiler must be protected by a sleeve of a size larger pipe.

Boilers to be supplied with the usual valves, gauges, trimmings, an approved make of grate bars, and a complete set of firing tools, consisting of steel scoop, poker, slice bar, hoe, and flue-cleaning brushes. Water supply will be connected through brass feed cocks with handles attached.

SMOKE BREECHING AND CHIMNEY.

The smoke breaching shall be made of No. 14 gauge black iron, well secured in position and properly equipped with clean-out openings and hand dampers. Smoke pipe to pitch up toward chimney, and, where necessary to make bends, it must be done with four-piece elbows. Chimney to be at least _____ square. It must be smooth inside, and extend above all near surrounding buildings.

VACUUM PUMP.

Furnish and install on a suitable foundation where shown on plan one vacuum pump of suitable size. Discharge from pump to be into receiver of boiler feed pump. Pump to have brass lining in water end, tobin bronze piston rod, and brass fittings.

VACUUM PUMP GOVERNOR.

Install in steam supply pipe to vacuum pump a 1/2-inch vacuum pump governor of _____ make. Connect diaphragm chamber of governor to return main at least 15 feet from vacuum pump.

BOILER FEED PUMP.

Heating contractor will furnish and install one brass fitted boiler feed pump and receiver where indicated on plans. (Pump to have tobin bronze piston rod and brass lining in water end, and brass fitted.)

LUBRICATORS.

Pumps to be equipped with not less than 1/3 pint sight feed cylinder lubricators of an approved make.

GREASE SEPARATOR.

Heating contractor will furnish and install where shown on the plans one oil separator properly dripped to sewer or sump through an approved trap.

DIRT POCKET.

Install in return line a tee the size of the vacuum pump suction. The run of the tee to be vertical, and the branch to connect to the vacuum pump suction. The return to be connected to the upper opening of the run and the lower opening to be provided with 8-inch nipple and cap, which can be removed for cleaning.

POP SAFETY VALVE.

Install in exhaust main where convenient in boiler room a 2-inch pop safety valve, set for 10 pounds pressure.

GAUGES AND BOARD.

At convenient place in boiler room install on white marble gauge board one 6-inch vacuum gauge and one 6-inch low pressure gauge. The vacuum gauge shall be connected to return lines of system and the pressure gauge to low pressure steam mains. Gauges shall be properly installed on board, with water seal loop on low pressure gauge.

PRESSURE REDUCING VALVE.

Where shown on plans install one pressure-reducing valve, properly by-passed, as shown on plans.

BY-PASSES.

Pumps, reducing valve, and pump governor should be equipped with by-passes, with cut-out valves installed therein.

MAINS.

Main supply pipes to be run on basement ceiling, as shown on plans, with a pitch of 1/2-inch in ten feet when in direction of flow of steam, and 2-inches in ten feet when opposite to direction of flow.

Return mains to run as indicated on basement ceiling, with a pitch toward the vacuum pump. A gradual rise to vacuum pump will not be allowed. Where it is found necessary to raise the return, it must be done by use of proper lift connections. This raise shall be made by means of a tee, with the run vertical, and the return connected to the branch. The lower opening of the run to the supplied with

nipple and cap. The upper opening to be provided with a bushing, so that the vertical part of the return pipe to pump can be screwed down by means of a long thread into the pocket formed by the nipple and cap.

EXPANSION OF MAINS.

Due allowance must be made for caring for expansion and contraction of all piping. Where in the opinion of the heating contractor it is necessary, double-swing joints shall be installed, to take up the expansion in mains or risers, so that no pockets will be formed by extreme expansion.

HANGERS.

All pipes on basement ceiling shall be suspended from ceiling through an approved make of hangers spaced not more than ten feet apart in a neat and substantial manner, and so as to allow no sags or pockets to develop in the piping.

RISERS.

All risers to be supplied by spring pieces taken off top of main with 45 degrees elbows. Spring pieces to be one size larger than the riser they supply, or, if over five feet long, two sizes larger, unless otherwise shown on plans.

VALVES.

All valves except radiator valves over 2 inches to be iron body, brass trimmed, with iron wheels. Gate, globe, or angle valves to be supplied according to contractor's best judgment. No cheap grade of check or other valves will be allowed.

RADIATOR VALVES.

Contractor will furnish and install on all radiators heavy pattern, rough body, brass radiator valves, with wood wheels and Jenkins discs.

DRIPS.

Drip ends of mains, and the rise in main where indicated, through traps. If of necessity any changes of piping must be made to overcome obstacles that were not contemplated when these plans were made, that will cause any pocket to sag in piping, provision must be made for dripping same through traps. In this case the heating contractor will be required to purchase, at his own expense, what extra traps or piping that will be required to properly make the change.

PIPE AND FITTINGS.

All pipe and fittings to be of best quality, and all joints reamed and freed from burrs. All joints to be iron to iron, and tested right.

RADIATION.

The contractor will place all radiation, as shown on plans. Any change that may be desired as to the amount or position must be referred to the architect, for his approval.

There shall be a total of _____ square feet of direct steam radiation, consisting of standard cast iron radiators of _____ or other approved make, distributed as shown on plans. All air vent openings to be plugged.

RADIATOR TRAPS.

On the lowest point of each and every radiator in the building and on the opposite end from the inlet there shall be placed a radiator trap.

RETURNS.

All return pipes from traps to be as shown on plans, and to drop into top of return. Returns shall be free from sags or pockets, and have a pitch of 1/2-inch in ten feet toward vacuum pump.

TESTING.

The contractor shall thoroughly test the apparatus in the presence of the owners and architect. All low pressure piping, exhaust, etc., shall be subject to a test of ten pounds,

without displacing, straining any portion of it, or causing it to leak.

PAINTING.

Painting will (not) be included under this contract.

COVERING.

All low pressure supply pipes and spring pieces to be covered with 1-inch air cell sectional pipe covering of an approved make. Joints and elbows to be plastered flush with covering, with plastic asbestos cement, to be applied while pipe is hot, and covered with duck, neatly pasted down. Returns to be left uncovered.

CLEANING.

After the whole system has been in operation for two weeks the contractor will go over it carefully, cleaning out all accumulations of scale and dirt and leaving the whole system in perfect running order. The contractor will also clean up any dirt or rubbish and leave the premises clean and neat.

VENTILATION SPECIFICATIONS

FAN.

Specify make, type, construction (such as housing, bearings, etc.), requirements as to noise. State number of cubic feet of air to be handled per minute and the overload capacity required. Rating, efficiency, and other details of design are fixed by the manufacturers.

ENGINE.

Specify kind of drive required—i.e., engine or electric motor; for engine drive state make of engine, type, horse power requirements, and speed, if these are known, and such details of construction as may be desired. For motor drive specify make of motor, type, r.p.m., kind of current, direct or alternating, voltage, phase, cycles, and control required.

As with fans, engines and motors are manufactured according to specifications prepared by the makers, and the architect is only called upon to choose the machine best fitted to his purpose.

HEATER.

To be furnished a stack of heater coils, large enough to handle _____ cubic feet of air per minute, with a velocity at no point more than _____ ft. per minute. The air to leave the heater at not less than _____ degrees, even when taking cold air from outside, at _____ degrees below zero. The coils to be arranged in independent sections and supplied with branch pipes, with valves on both supply and return connections to each section. The coils to be encased in gauge sheet metal casing, braced with angle irons connected to fan inlet, with inspection door below. Inlet Connection.—The heater casing is to be extended to fresh air intake,

and to be provided with suitable door for admission. The fresh air intake to be provided with frost-proof damper, fitted with suitable frame, and operating levers, to hold rigidly at any desired angle. The inlet opening to be riveted with wire mesh screen gauge _____ mesh with _____ iron frame securely held in position.

AIR DUCTS.

In the main pipe let the velocity be the same as through the heaters, gradually decreasing so that at the register openings the velocity be not more than 250 to 400 feet for public buildings and 400 to 600 feet for factories and warehouses.

GALVANIZED IRON DUCTS.

The system of conduits for distributing the air to the various parts of the buildings will be installed according to the plans _____ and made of the best grade galvanized steel.

The sheets used in the construction of the conduits will be of the following gauges:

(For Round Pipes.)

	Gauge No.
6 inches to 15 inches.....	26
16 inches to 25 inches.....	24
26 inches to 33 inches.....	22
34 inches to 42 inches.....	20
43 inches to 60 inches.....	18
Above 60 inches.....	16

(For Rectangular Pipes.)

	Gauge No.
4 inches up to 18 inches wide.....	26
19 inches up to 30 inches wide.....	24
31 inches up to 40 inches wide.....	22
41 inches up to 50 inches wide.....	20
51 inches up to 60 inches wide.....	18
Above 60 inches wide.....	16

Only first quality, smooth-finish, cold-rolled sheets of the best grade of soft steel will be used, guaranteed to double seam without showing fracture.

All elbows or turns to have an easy bend, with a radius in throat not less than diameter or width of the pipe of which they are a part, except those on Y branches or tees, which will have such a radius as is best suited for them.

All pipes or conduits are to be securely hung in position by iron bands, No. 8 wire, or carried on suitable cradles, as best suits the occasion.

Whenever necessary to equalize the distribution of the air, suitable deflector dampers will be fitted in to the conduits. These can be adjusted with quadrant on outside of pipe and permanently fixed in position after the plant is in operation.

Each outlet, unless otherwise marked on the plans, will be fitted with a galvanized damper; same to have a means for holding the damper in any fixed position between full open and closed. Registers will be provided where marked on drawings.

DIFFERENCE IN GAUGE NUMBERS.

American or Brown & Sharp gauges of the same number will average nearly 20 per cent. less in thickness than the gauges here given.

PUMP AND RECEIVER.

One automatic pump and receiver shall be furnished with this contract to handle the condensation from _____ square feet of direct radiation and _____ square feet of fan stack radiation. Pump to be full brass fitted and mounted, with the receiver on a neat cast iron sub-base, with oil groove and drain hole (the pump to be operated with steam at _____ lbs. pressure). (The pump to be driven by a direct connected electric motor, suitable for _____ volts _____ cycles alternating _____ direct current, and to be supplied complete with motor and self-starting float, with chains and pulleys.)

AIR WASHER.

To have a capacity of _____ cubic feet of air per minute. The dimensions of a cross section of this washer taken in a plane perpendicular to the passage of air through the washer shall be such that the velocity will not exceed 500 ft. per minute.

Casing.—The casing shall be constructed of _____ gauge galvanized iron, braced on the outside with _____ angles, which shall be spaced not further apart than _____ ft. All joints in casing shall be either soldered or made tight with gaskets. Sides, top, and tank to be made separately (if desired), with angle edges, which are to be bolted together with gaskets between, thus allowing the removal of any part for repairs when necessary.

A door to permit inspection of, and easy access to, the interior of the machine is to be provided. The door shall be of _____, with glass panels, each glass being not less than _____ . The door frame is to carry

pure rubber gasket, against which the door is to be held closed by suitable device. Frame is to be _____ iron, riveted and soldered to the washer casing, and shall be of sufficiently rigid construction throughout to prevent the cracking of glass when the door is rigidly clamped against the frame.

The settling tank (or sump) to be constructed of _____ gauge galvanized iron (or concrete), and is to be _____ in height. Tank is to be properly riveted and soldered throughout and rigidly braced with angle iron, spaced not further apart than _____ . It is to extend under entire washer.

Strainers.—There shall be provided a strainer, which will form a chamber in one end of the tank, from which the water will be taken to the suction of the centrifugal pump. This strainer shall be at least 1 sq. ft. in area for each foot in width of the washer. This strainer shall be constructed of _____ mesh copper wire screen, rigidly held in galvanized band iron frame. The top of the suction chamber is to be covered with a galvanized iron door, to prevent the entrance of dirt from the top.

Inserted in the line running from the centrifugal pump to the spray header shall be a galvanized cast iron pot strainer. This strainer is to be provided with basket of _____ mesh copper wire screen held on brass ring, which forms a top, and rigidly braced with brass strips. An extra basket is to be provided for insertion in the strainer while dirty basket is being cleaned. The pot shall be so constructed that ready access may be had to the strainer in order to remove baskets. Top shall close against a 1/4-inch by 1/4-inch pure rubber gasket, so as to form a water-tight joint.

Eliminators.—The eliminators are to be made of galvanized iron, braced and stiffened with galvanized iron angles. They are to be set in rows, evenly spaced, being not more than _____ inches apart.

PUMP.

The washer is to be provided with a centrifugal pump, arranged to be direct driven by electric motor, having a cast iron sub-base which shall be extended to receive the motor. It is to be carefully balanced and be provided with brass gland. Impellers are to be of enclosed type.

PIPING.

Piping connections between the washer and pump shall be of extra heavy galvanized iron pipe. Spray header inside the tank shall be of _____ . Flange connections will be left in the washer casting for drain pipe, overflow, and water supply. Inside washer tank is to be provided a 3/4 inch float valve for maintaining a constant water level, and also a bell-mouth overflow, which shall be connected to the drain. (A valve is to be provided in the line leading to the main sprays, so that main sprays can be shut off in very humid weather, and washing effect obtained by running the flooding nozzles.)

GUARANTEE.

The air washer to be guaranteed to remove 98 per cent. of all solid matter from the air current, and in summer when using cold water to reduce the temperature of the air, so that the difference in temperature between the outgoing air and the water will be 25 per cent. of the difference in the incoming temperatures. The eliminator must remove all free moisture, or water not in the form of aqueous vapor. The plant must also be guaranteed to automatically control the relative humidity to within degrees.

HUMIDITY CONTROL.

There shall be provided in connection with this washer, automatic humidity control, procured by thermostatic control of the temperature of the air passing the washer and

of the water used. The thermostat used in connection with this apparatus shall be a graduated action, all metal thermostat. The variation of the humidity shall be procured by variable water temperatures controlled by thermostat mentioned above. Water temperature shall be varied by means of water heater. Specify make, capacity, etc. The humidity controlling system shall be complete, with diaphragm valves, air duct thermometers, strainers, water heater, and thermostat, all erected by an expert of the manufacturers. One (1) $\frac{1}{8}$ inch air line outlet is to be left by the thermostatic control contractor for furnishing the air supply to the thermostat mentioned above. Complete drawings and specifications of the above-named air washer and humidity control must be approved by the engineer before work is begun on the apparatus.

GAS HEATING SYSTEMS**PIPING.**

General Plan.—Locate motor and fan conveniently for exhaust into flue or out of building. From fan, extend main exhaust pipe and branches to each radiator, or to risers for radiators on various floors, gas pipe to be similarly extended from meter.

Main exhaust pipe which connects branches and risers should be 2 inches (I.D.) for installations up to 20 radiators, if not exceeding a total piping of 200 feet., $2\frac{1}{2}$ inch pipe for 20 or 40 radiators, 3 inch for 40 to 60 radiators, and larger in same proportion. The larger the piping, the less the maintenance cost of motor.

Branch exhaust pipes should not be less than $1\frac{1}{4}$ inch (I.D.), fittings to be preferably of long sweep recessed drainage type, in order to reduce friction. White or red lead, or joint compound to be put on the threads of pipe and not in fittings. **All horizontal pipes must have a fall of not less than 1 inch in 6 feet to drainage point**, and to be securely supported by metal straps or hangers to prevent possible sag. Where laid in wall or ground, every precaution must be taken to prevent pipe settling and forming water pocket. Pipe should also be covered with asphaltum.

WATER TRAP.

Water trap with at least a 6 inch seal must be placed at the drainage point of installation with $\frac{3}{4}$ inch pipe emptying into sewerage or surface drain, should be accessible, easily cleaned, and fully protect the fan from water of condensation.

MOTOR AND FAN.

Motor and fan should be installed so as not to come in hard contact with any part of piping or building. Soft connections should

be used in connecting pipe on both intake and exhaust sides of fan. Place 2 inch cork mat between fan and shelf on which it rests. A second mat of felt between cork and shelf will still further kill vibration. Best location for motor is on specially constructed shelf or in recess formed in the basement wall.

A 1/15 H.P. motor is sufficient for up to 15 radiators, 1/8 H.P. motor is sufficient for up to 30 radiators. It is often advisable to break up a large installation into two or three small ones operating independently.

Electrical wiring to motor to be done according to local building laws.

EXHAUST PIPE.

Exhaust pipe from fan to exhaust port should be 4 inch galvanized leader pipe or larger. Use a globe ventilator, or equivalent, on exhaust to prevent back drafts, thus protecting pilots when fan is not running. Do not exhaust into basement, or near window where fumes can be carried into the house. When exhausting into chimney flue, **be sure** flue is unobstructed and sealed at fire places and all points to prevent fumes from backing into house.

GAS PIPE.

In estimating capacity, figure a maximum delivery of 25 cu. ft. of gas per hour per radiator at 1 inch pressure. Gas piping to be done according to local building specifications. Use galvanized fittings and brass unions. A gas cock should be placed back of each radiator.

RADIATORS.

Radiators are assembled on the job. **See that all joints are air-tight.**

VALVES.

Valves to be screwed to bottom of burner box **absolutely tight** to prevent air leakage into the burner box. Place burner head in burner box seating on bunsen tube, with pilot tube extending into pilot body.

FLAPS.

Screws holding flaps in rear of burner box must not be screwed up tight, as flaps must swing open to sustain pilot when the motor is not running.

THERMOSTATS.

Thermostats should be placed on inside wall fully 10 feet from radiator and at a height of 5 feet. Neither thermostat nor its supporting screws should come in contact with any metal in wall. They may be insulated by using wooden blocks.

Any good type transformer connected to the lighting system may be used for operating the thermostats.

Six dry cells connected in series will furnish voltage enough for any number of radiators. In installations of 10 to 30 radiators use 6 cells in series, four in multiple, for 30 to 60 radiators use six in series, four multiple, etc.

PAINTING.

Aluminum paint is the most practical paint to be used on radiators. Gold bronze will discolor. All oil and grease must first be completely burned off by operating several hours. Apply paint while radiator is slightly warm;

then operate radiator until thoroughly dried. It is important to see that no paint gets on seats of door in front, or of traps in rear of burner box, as these must seat air-tight when the motor is running, and might also cause traps to stick when motor is stopped.

TO LIGHT AND REGULATE PILOT.

First turn on motor, setting thermostat back to 40 to shut gas from burner. Light pilot, and while motor is still running, turn down pilot until its color changes from yellow to green. When motor is stopped this becomes a $\frac{1}{2}$ inch flame with yellow tip. If pilot goes out as fan starts, look for air leaks around door lower trap, or burner. If it goes out when fan is not running, it is due to back draft, trap sticking, or pilot turned too low.

TO REGULATE GAS SUPPLY.

First see that air regulator is open about two full turns, then gradually unscrew gas regulator until you obtain a violet flame. There are several ways to determine the proper flame for the best results, the best way being to regulate until the flame has a tendency to lift slightly from the outer edges of the burner.

TO INCREASE GAS CONSUMPTION.

When more heat is required, open air regulator about half turn and regulate to burn with violet flame. To decrease gas consumption, close air regulator half a turn and screw down gas regulator until violet flame is obtained.

Heating and Ventilation of Buildings, Prof. R. C. Carpenter. Jno. Wiley & Sons, New York.
Steam Heatings for Buildings, William J. Baldwin. Jno. Wiley & Sons, New York.
Hot Water Heating and Fitting, Baldwin. McGraw-Hill Book Company, New York.
Mechanics of Heating and Ventilation, Meier. McGraw-Hill Book Company, New York.

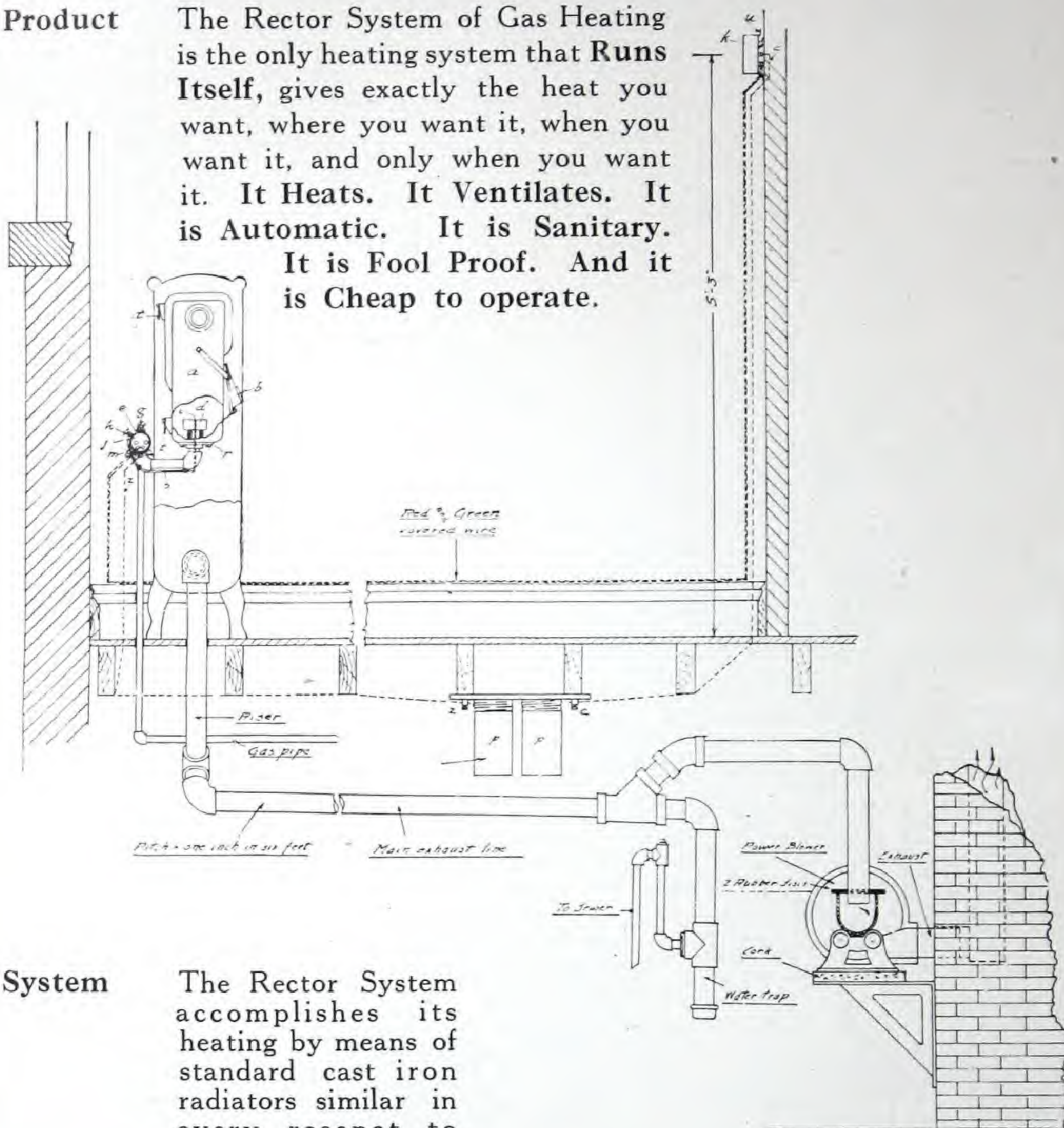
THE CANADIAN RECTOR GAS HEATING CO., LTD.

Tanner & Gates Building
26 and 28 Adelaide St. W., TORONTO

320 and 322 Lister Chambers
James St. N., HAMILTON, Ont.

**Manufacturers of the Rector Appliances for Perfect Heating
with natural or artificial gas.**

Product The Rector System of Gas Heating is the only heating system that **Runs Itself**, gives exactly the heat you want, where you want it, when you want it, and only when you want it. It **Heats**. It **Ventilates**. It is **Automatic**. It is **Sanitary**. It is **Fool Proof**. And it is **Cheap to operate**.



System

The Rector System accomplishes its heating by means of standard cast iron radiators similar in every respect to those used in hot water or steam systems. Each radiator is equipped with a special gas burner the flame of which, and therefore the temperature of the radiator, is controlled by an individual thermostat. A single small W.I. pipe supplies each radiator with gas and a larger W. I. pipe connected to the return end of the radiator carries away all products of combustion.

In operation each thermostat is placed not less than ten feet from the radiator which it controls and about five feet from the floor of the room. A pilot light is maintained lighted at each

THE CANADIAN RECTOR GAS HEATING CO., LIMITED

radiator, and the thermostat, which may be set by hand to any temperature, operates upon the gas supply to the burner to maintain that temperature. After the pilot lights are lit in the fall the system requires no further attention.

The exhaust pipe, referred to above, is part of a system connecting each radiator to an exhaust fan which is kept running all the time the system is in operation. The function of this fan is to maintain a flow of air to the burners and constantly remove the waste products of combustion from the radiators. The discharge from the fan is led to any convenient chimney or outside of the building. By this means the double purpose is served of keeping the foul air of the burners from escaping to the rooms and at the same time producing a highly desirable, but moderate, change of air in each apartment.

It is well known that the efficiency of any radiating body is a function of the temperature range, hence the Rector radiators which reach a temperature of 500° Fah. if desired, are remarkably efficient compared to steam or hot water which seldom exceed 220° Fah. This leads of course to relative small radiators, effecting considerable saving in first cost. Five hundred degrees Fahrenheit it may be added is well below the ignition point of paper, fabrics, or wood.

Temperature Regulation

There is no reason whatever for at any time tinkering with the radiators. All parts are so arranged that inquisitive people can not readily interfere. The thermostat exposes only a "hand" which may be turned, to the various graduations representing temperatures as required. These thermostats are electrically operated from a central battery or transformer. An electric motor of one-fifteenth horse power is large enough to drive the exhaust fan of a system of fifteen medium sized radiators. A ventilator is placed on the discharge pipe from the fan to prevent back drafts from extinguishing the pilot lights when the fan is not running.

COST OF HEATING BY RECTOR SYSTEM

Cost

The question of comparative cost is naturally one of the first to be asked. The answer is easy enough in localities where natural gas is available. Anyone who has been heating by natural gas—whether hot air, hot water or steam, may confidently rely on the **Rector System** to reduce his gas bills from 30 to 60 per cent. according to the system replaced. In the majority of cases a 30 per cent. saving may be absolutely assured.

In cities supplied with artificial gas, the question is complicated by the various prices of gas and coal, and by the richness of the gas in heating qualities. Generally, with gas at \$1, or more, per 1000 cubic feet and coal at \$7.50 per ton, one should not expect to heat with gas at a cost less than coal—although one should come very near it with gas at 70 to 80 cents. Most gas companies, however, are making lower prices for gas used for industrial, or heating purposes,—some as low as 60 to 70 cents even where \$1 is charged for gas used for lighting.

For details of the general arrangement the reader is referred to the accompanying drawing which shows the relative positions of the various parts.

THE JAMES STEWART MANUFACTURING CO. LIMITED WOODSTOCK, ONT.

Western Warehouse: 151 Notre Dame Ave. East, WINNIPEG

MANUFACTURERS OF "GOOD CHEER" Circle Waterpan Warm Air Furnaces STOVES, RANGES, REGISTERS, Etc.



House Heating

Study the house heating problem, and begin with the question "is there a difference in the quality of the atmosphere in the house and that of nature's air outdoors?" Do you realize that the house-heating installations you are making are responsible for a "climate" in the house drier than the desert of Sahara? It is so, nevertheless, and accounts for the general uncomfortable-ness of our homes in winter; the necessity of high temperatures of the heated air, and the many throat troubles and more serious ills which flourish during the season when our homes require artificial heat.

Modern Practice

Modern heating practice specifies proper humidity provision and has the strong endorsement of science. The Good Cheer Warm Air Furnace, with its large Circle Waterpan, has, during the past three years, demonstrated what ideal house heating conditions are, and we shall be pleased to send you, on request, literature illustrative of what a **real** furnace is, and how important a part the proper moistening of the heated air plays in the general comfort and health of the household, and the economy of fuel consumption.

Humidity

Even with a water evaporation of from 5 to 10 gallons every 24 hours, according to size of house and furnace, we do not promise higher than 55 per cent. humidity. Normal outdoor humidity is about 70 per cent., while in the average house it runs from 18 to 25 per cent.—drier than a desert. See the point?

Architects Corres- pondence

We particularly invite architects to write us, as we also have several lines of warm air furnace accessories which will interest them.

C. A. DUNHAM CO., LTD.

TORONTO, - CANADA

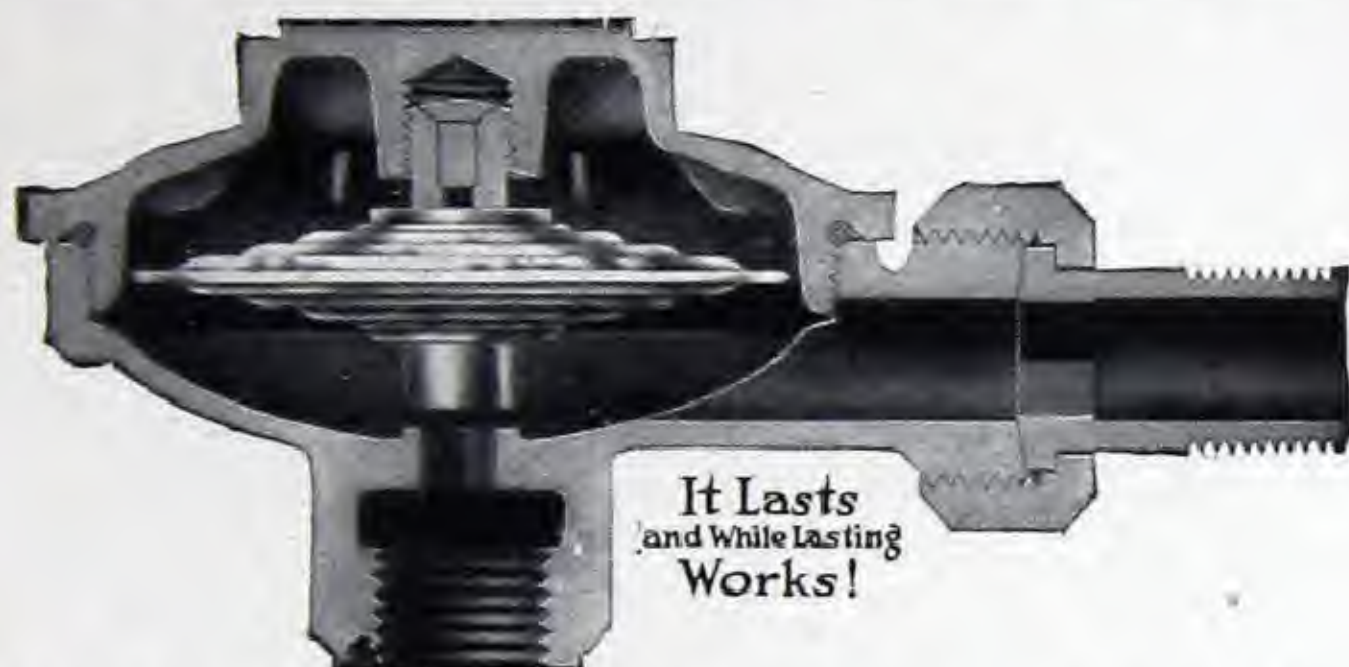
VANCOUVER CALGARY WINNIPEG MONTREAL HALIFAX

Dunham Vacuum and Vacuo-Vapor Steam Heating Systems

Manufacturers and Sales Agents for the following

STEAM SPECIALTIES

Dunham Thermostatic Radiator Traps and Dunham Thermostatic Blast Traps and Fisher Pressure Reducing Valves and Pump Governors, Steam and Power Vacuum Pumps, Boiler Feed Pumps and Receivers, Strainers, Gauges, Etc.



**THE
DUNHAM
RADIATOR TRAP**

FUNCTION—The prime essential of any high class heating system of the Vacuum or Vacuo-Vapor type is the Dunham Radiator Trap, shown here in cross section one half its full size, for unless the water of condensation and air which accumulate in every system can be kept from the steam, it is utterly impossible to obtain satisfactory heating. The function of the Dunham Radiator Trap is to automatically and continuously accomplish this separation. A trap is connected to the return end of each radiator or coil for this sole purpose of retaining steam in the radiator and yet allowing the free discharge of water and air to the return line.

DESCRIPTION—Examine the illustration. The disk seen suspended from the cover of the trap is a corrugated flexible receptacle containing a combination of volatile fluids. On the lower part of the disk is the valve which hangs over a three-eighths inch opening in the trap leading directly to the return line. When installed the chamber of the trap containing the disk is connected directly to the radiator, hence the conditions that exist in the radiator always exist around the disk.

OPERATION—Sealed within the disk, it has been noted, are certain volatile materials so selected and proportioned that they are fluid at the temperature of the water of condensation which the trap is designed to pass, and as fluids they exert no internal pressure upon the disk. Let steam come in contact with the disk, however, with its temperature some degrees higher than that of the water and these fluids are at once evaporated, thereby setting up a vapor pressure with the disk sufficient to expand it and close the trap. When the temperature drops, due to loss of heat by radiation, the cooler condensation of air collected around the disk and the volatile substance contained therein is in turn condensed. The disk collapses and the water and air are admitted to the return line.

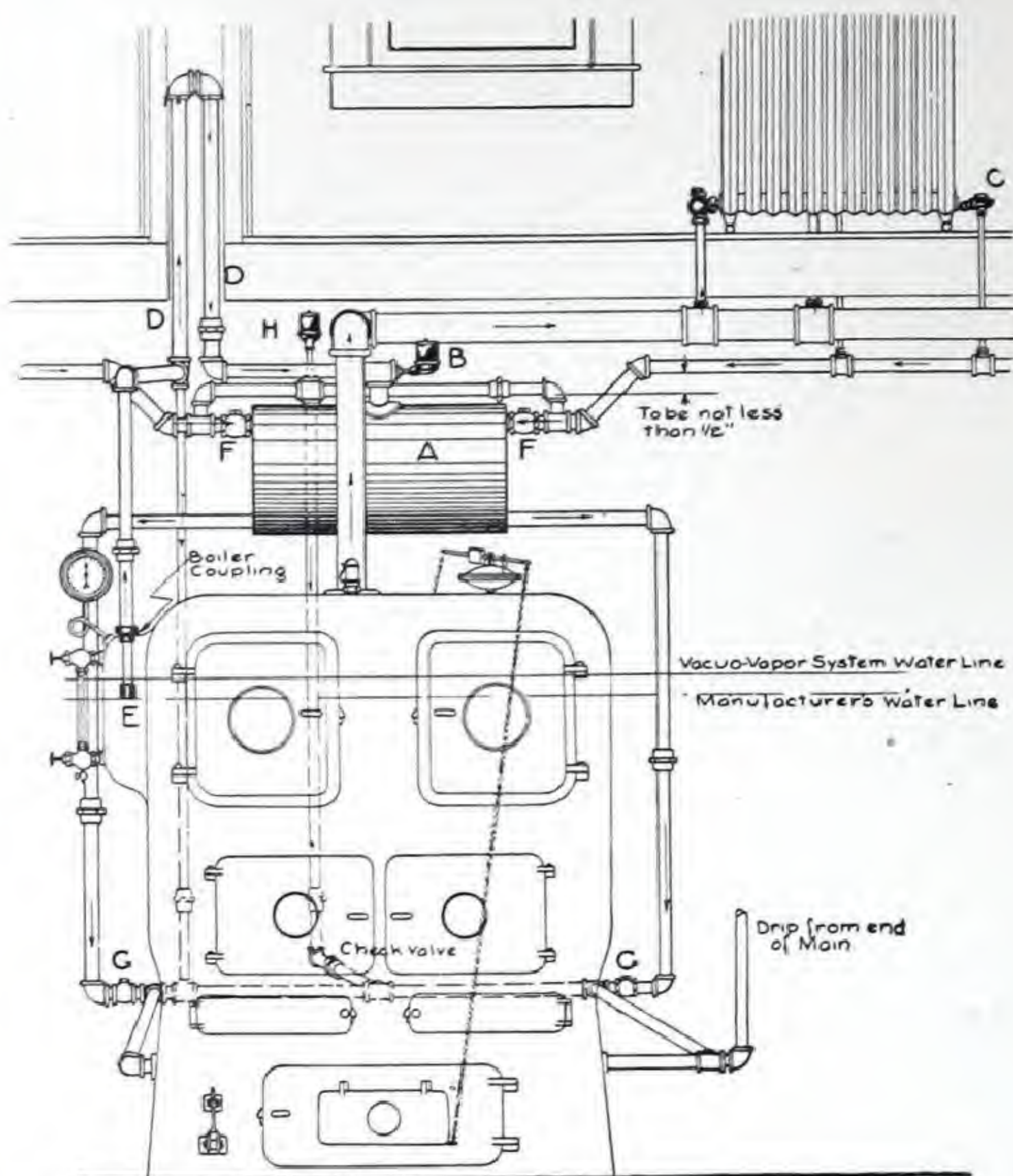
RELIABILITY—This thermal difference between steam and the water of condensation formed from it, is a physical constant. It exists at all steam pressures and under all circumstances, hence, so long as the quality of the Dunham Radiator Trap remains unimpaired, its operation is as certain as the return of night and day.

CONSTRUCTION AND SERVICE—There are no floats or expansion plugs of any description used in the construction of the Dunham Trap. The combined disk and valve are securely anchored in direct line with a flat seat. The trap is entirely free from sliding contacts, working joints, and hence, from friction. The cap is carefully fitted and made perfectly tight. To this cap is secured the disk which is adjusted to meet the service for which the trap is intended and permanently set before leaving the factory. A brass union is provided for attaching to the radiator. The trap remains open when cold, and as there is no water seal it can not freeze.

POSITIVE GUARANTEE—The Dunham Trap is guaranteed to give entire satisfaction on any vacuum return heating system. They will pass all air from the system without the use of air valves, at the radiators, also all condensation, will close tight against the passage of steam and absolutely eliminate the use of spray water at the vacuum pump.

Continued on next page

DUNHAM VACUO VAPOR SYSTEM



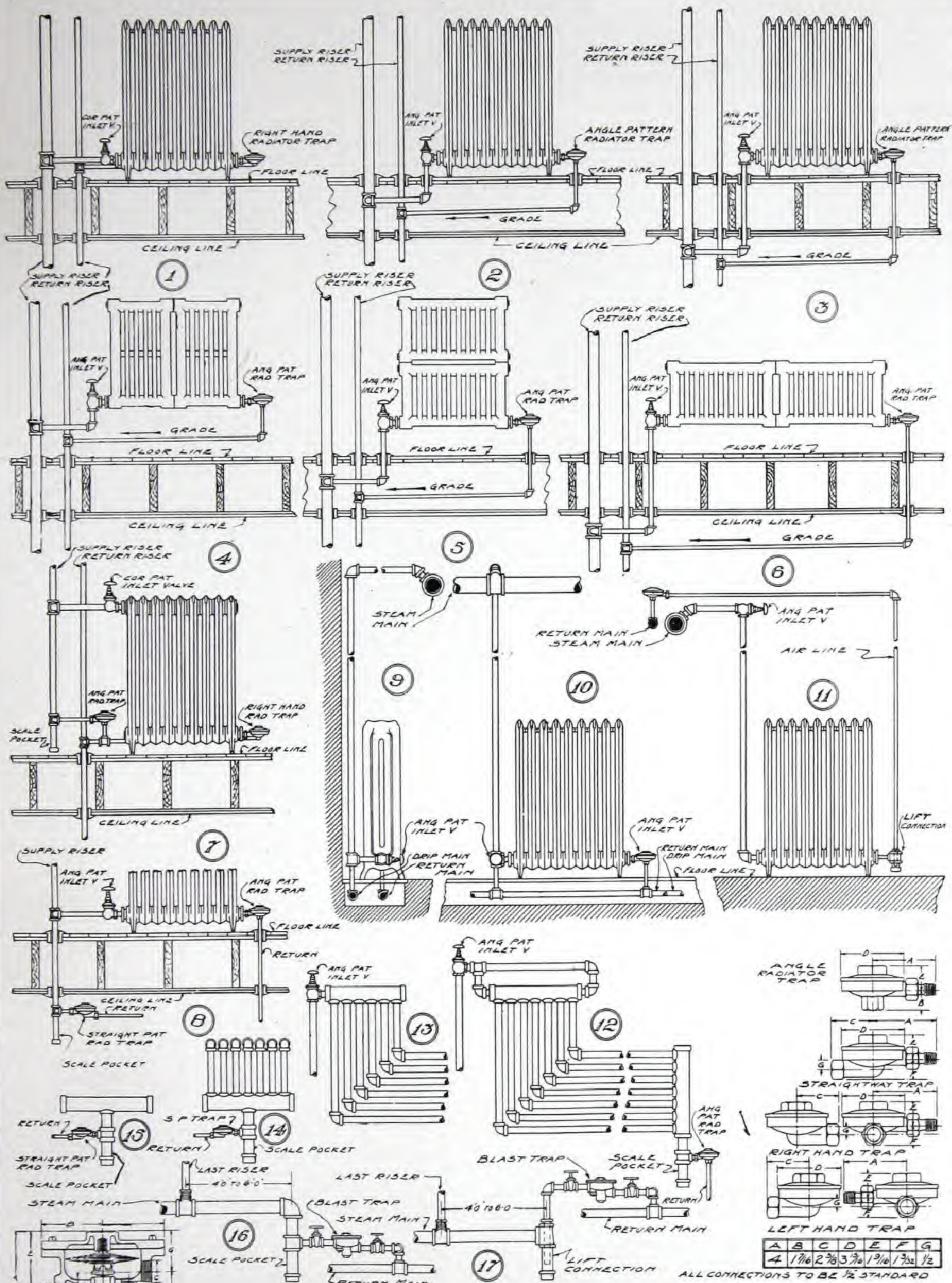
Steam produced in the boiler flows out through steam main into radiation driving, all air ahead of it through the Dunham Radiator Trap "C," into the return line, thence to the return tank "A," from which it escapes to atmosphere through Dunham Automatic Air Valve "B." The steam in the radiator following the air closes Dunham Radiator Trap "C" and is held in the radiator and kept from escaping into return line. As the steam in the radiator condenses, the condensation flows into the Dunham Radiator Trap "C," which opens to discharge it into the return pipe, from whence it flows into the receiving tank "A." As soon as the condensation flows out of Trap "C" steam flows in and the trap immediately closes.

This process continues in all radiators and the condensation collects in the receiving tank. Referring to illustration you will discern equalizing tube "D" extending down into boiler below the water line and looping above boiler and thence down into receiving tank "A." This tube keeps the pressure in the boiler from communicating itself to tank "A" until the water of condensation accumulating in tank "A" is of such quantity as to lower water in the boiler below the equalizing tube bell "E." At this moment steam from the boiler rushes up through the equalizing tube "D" and into tank "A," immediately closing air valve "B," also check valves "F." When the pressure in tank "A" becomes the same as that in the boiler the water in tank "A" flows into the boiler through checks "G" by gravity. The water thus entering from tank "A" raises the water line in the boiler and seals the equalizing tube "D," leaving tank "A" full of steam. This steam condenses and forms a suction of varying degrees throughout the return lines.

The air valve "H" is installed for the purpose of permitting air to continue to pass from the system when tank and boiler are equalizing.

If more convenient the equalizing tube "D" can be connected to boiler through a standpipe which eliminates necessity of tapping boiler for same.

The differential in pressure between boiler and tank is always sufficient to exhaust the air after which the system frequently acts as a sealed gravity system, permitting the condensation to flow directly to boiler without accumulating in tank at all. Such conditions are ideal, permitting steam to enter the radiation exactly in proportion to rapidity of condensation therein.



TYPICAL CONNECTIONS

1. Runouts above floor.
2. Runouts in floor construction.
3. Runouts on ceiling below.
4. Runouts above floor.
5. Runouts in floor construction.
6. Runouts on ceiling below.
7. Riser above first floor.
8. Riser drained in basement.
9. Drip main and return main in trench below basement floor.
10. Side elevation of No. 9.
11. Return main on ceiling, with lift connection at radiator. This method to be avoided where possible.
12. Wall Coil. Supply and return connections to coils of seven pipes or more.
13. Wall Coil. Supply connections to coils of six pipes or less.
14. Ceiling Coil. End elevation of drop-leg coil drained by radiator trap.
15. Ceiling Coil. End elevation of coil, drained by radiator trap.
16. Where return main is below steam main.
17. Where return main is above steam main.

THE C. A. DUNHAM CO., LIMITED

ARCHITECTS

HEATING CONTRACTORS

C. P. R. Hotel.....	Banff Springs, Alta.....	W. S. Painter.....	Regina Plb. & Htg. Co.
Battleford Asylum.....	Battleford, Sask.....	Prov. Government.....	R. G. Sturgeon & Co.
Goodyear Tire & Rubber Co.....	Bowmanville, Ont.....	Owners.....	Drake-Avery Co., Hamilton, O.
General Hospital.....	Brantford, Ont.....	W. W. Horwood, Prov. Arch.	Drake-Avery Co., Hamilton, O.
Y.M.C.A. Building.....	Brantford, Ont.....	Owners.....	McGregor & Mitchell
Brandon Asylum.....	Brandon, Man.....	Owners.....	McKelvey & Birch, Kingston, O.
Canada Carriage Co.....	Brockville, Ont.....	Owners.....	Owners.....
International Harvester Co.....	Chatham, Ont.....	Government.....	Campbell & Hillier
Lougheed Block.....	Calgary, Alta.....	Lang & Dowler.....	Grant Bros.
Police Headquarters.....	Calgary, Alta.....	Government.....	J. A. Lockerbie Ltd.
Westminster Apartments.....	Calgary, Alta.....	Government.....	Anderson & Co.
Parkdale School.....	Edmonton, Alta.....	R. A. Johnson.....	Longard Bros.
Grain Exchange Bldg.....	Fort William, Ont.....	Owners.....	Owners
Western Union Cable Co.....	Halifax, N.S.....	S. B. Bird.....	S. A. Wye
Knechtel Furniture Co.....	Hanover, Ont.....	E. E. Carver.....	Hick-Sehl Hdwe. Co.
Royal Inland Hospital.....	Kamloops, B.C.....	Owners.....	Owners
Sherlock Building.....	Lethbridge, Alta.....	T. J. Lawson.....	T. H. Reeve
McClary Mfg. Co.....	London, Ont.....	Storey & Van Egmond.....	Jas. Ballantyne & Co.
Hull Block Offices.....	Medicine Hat, Alta.....	Ross & McDonald.....	Thos. O'Connell
Times Building.....	Moose Jaw, Sask.....	C. A. Mitchell.....	T. Lessard & Sons
Emigration Detention Hospital.....	Montreal, Que.....	Ross & McDonald.....	Hickey & Aubut
Royal George Apartments.....	Montreal, Que.....	W. W. Horwood, Prov. Arch.	Hammond & Rodway
Read Building, Offices.....	Montreal, Que.....	Storey & Van Egmond.....	Regina Plb. & Htg. Co.
Old Folks Home.....	Portage la Prairie, Man.....	Provincial Architect.....	J. W. Wright Co.
McCallum Hill Bldg., Offices.....	Regina, Sask.....	Darling & Pearson.....	Hammond & Rodway
Agricultural College.....	St. Vital, Man.....	Owners.....	W. J. McGuire Ltd.
C.P.R. Office Bldg.....	Toronto, Ont.....	Owners.....	Owners
Toronto University Main Bldg.....	Toronto, Ont.....	Owners.....	Owners
T. Eaton Co. Ltd.....	Toronto & Winnipeg.....	Darling & Pearson.....	W. J. McGuire Ltd.
Dominion Bank Bldg.....	Toronto, Ont.....	W. M. Dods & Co.....	Rudd Bros.
Cook Apartment House.....	Vancouver, B.C.....	H. L. Stevens Co.....	Barr & Anderson
Duncan Building—Office.....	Vancouver, B.C.....	Gould & Chapney.....	Barr & Anderson
Rodgers Building—Office.....	Vancouver, B.C.....	Jesse M. Warren.....	W. J. Hanna
Central Building—Office.....	Victoria, B.C.....	Thos. Hooper.....	Colbert Plb. & Htg. Co.
Campbell Building—Office.....	Victoria, B.C.....	Ross & McDonald.....	Cotter Bros. Ltd.
Fort Garry G.T.P. Hotel.....	Winnipeg, Man.....	Ross & McFarlane.....	Cotter Bros. Ltd.
King George Hospital.....	Winnipeg, Man.....	J. D. Atchinson Co.....	Chas. E. Gate & Sons
Tribune Publishing Co.....	Winnipeg, Man.....		

**The Dunham Systems of Vacuum and Vacuo-Vapor Steam Heating
can be Adapted to Successfully Heat any Building**

We have installed Dunham Systems in the highest buildings in the British Empire and throughout the World, as well as in buildings ranging down in size to the small modern residence.



Castlemere Apartments
Toronto



C. P. R. Bldg.
Toronto



Woolworth Bldg.
New York, N.Y.

JOHNSON TEMPERATURE REGULATING CO. OF CANADA, LIMITED

MAIN OFFICE:
Toronto, 118 Adelaide St. W.

Branch Offices:
Calgary, Alta., 605 Second St. W. Winnipeg, 259 Stanley St.
Montreal, 8 St. Peter St. Vancouver, 1051 Seaton St.

Service and Products We contract for and install the Johnson System of Automatic Temperature Regulation and Humidity Control, to be applied to the heating and ventilating systems of occupied buildings, or the sources of heat used in the production of material in manufacture.

Thermostats, Humidostats, Valves, Dampers, Humidifiers, and all the necessary special apparatus for the Johnson System of Automatic Temperature Regulation. (Above is sold by contract only).

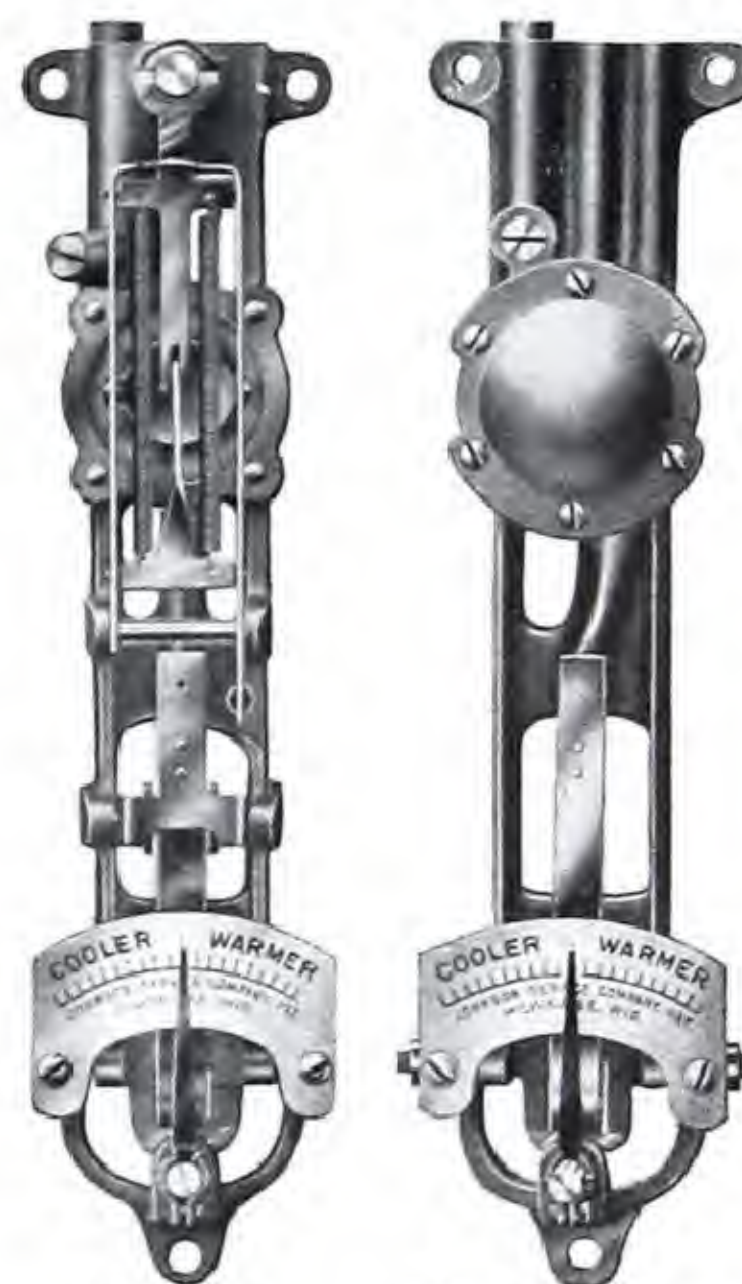
Hydraulic Thermostats, for automatically controlling the temperature of hot-water tanks. Regulating and Reducing Valves for all purposes. Above are sold to the trade at regular list prices and discounts.

Instruments for Indicating Temperature, Pressure Governors, and Pneumatic Specialties.

Application

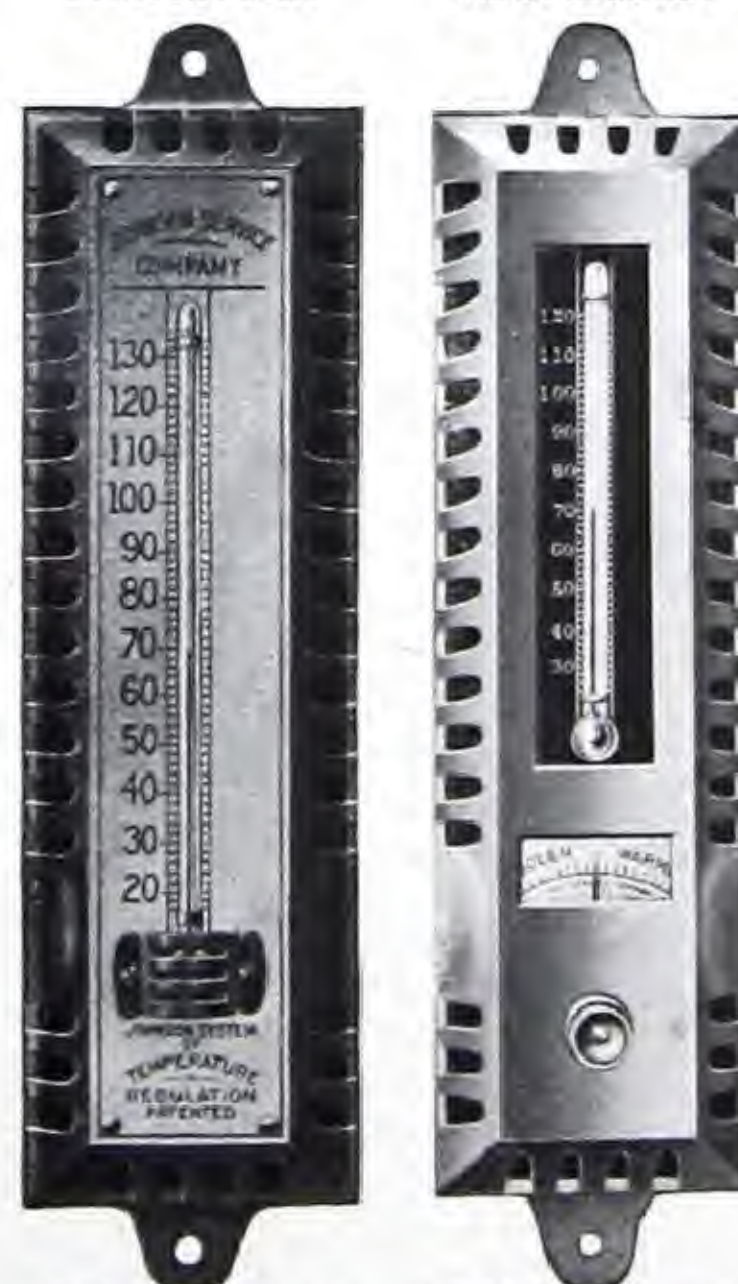
Temperature Regulating Systems can be applied to any form of Heating and Ventilating, direct steam, direct hot water, indirect steam, indirect hot water, gravity furnace, blast furnace, blast steam, blast hot water, or combinations. It is as necessary and as efficient with a hotwater heating system as with any other. Heat of any source and of any kind can be controlled properly only by automatic means. Hot water is no exception.

Thermostats, valves and dampers are manufactured in form and design to meet the most modern systems of Heating and Ventilation whether plain and simple or elaborate and complex.



Positive
Thermostat

Intermediate
Thermostat



School Cover

Office Cover

JOHNSON TEMPERATURE REGULATING COMPANY OF CANADA, LIMITED

Forms of Thermo- stat Movements

We install two general types of Thermostatic movement, the positive and the intermediate. The positive Thermostatic movement operates valves and dampers with a positive motion—shutting them tight and opening them wide—the only Thermostat that does this. It is absolutely necessary with single pipe systems of direct heating, to prevent water-hammer, and other disturbances and annoyances, incidental to partially opened valves.

The graduated or intermediate thermostat movement is used in connection with blast systems of heating and ventilation, having duplicate dampers controlling the supply of heated and tempered air. These graduated movements operate these double dampers in such a way as to hold both dampers partially open to mix the heated and tempered air to maintain a certain degree of temperature in the room to which the mixture is delivered. The thermostat does not depend upon leaks to effect this, but upon a mechanism which is accurate and reliable, and covered by patents. The thermostat is extremely sensitive and accurate in its operation, changing the relative positions of two dampers instantly on any change in the heated or tempered air, or temperature of the room, by holding the dampers in a poised position as long as conditions remain fixed.

Thermo- stat Fronts

Thermostats for occupied apartments are provided with metal covers to protect the mechanism. These covers are usually provided with a Thermometer, and are made plain or ornamental to suit the architectural requirements of the building.

Diaphragm Valves

Diaphragm Valves are made in any of the commercial styles, shapes and finishes. They are equal in quality to any and superior to most of the well known makes of Hand Controlled Valves. No change in piping plan is necessary because of the use of diaphragm valves.

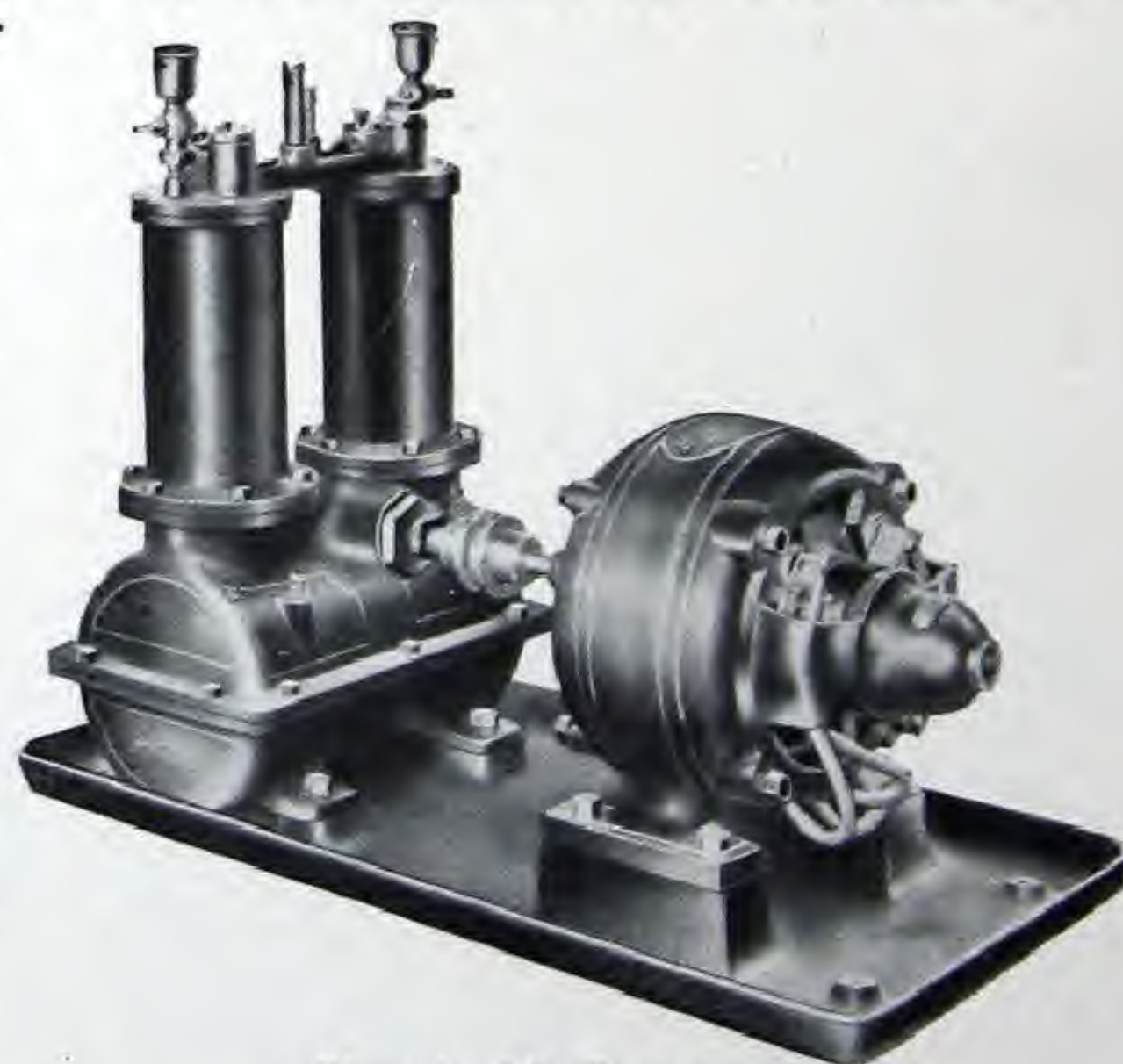
Dampers

Dampers in connection with Temperature Regulating Systems should always be furnished by the Heat Regulating Contractor to insure proper construction for operation by Thermostats, durability and efficiency.

We make all forms of dampers, for use in various kinds and shapes of ducts and in connection with various systems of indirect heating. The principal kinds are Single Square, Single Round, Double, Right Angle, Double End-to-End and Louvre.



Radiator Diaphragm
Valve



Electric Air Compressor

JOHNSON TEMPERATURE REGULATING COMPANY OF CANADA, LIMITED

Air Compressors Our Air Compressors are Hydraulic, Electric, Steam, or Power driven.

For small plants, Hydraulic or Electric are most suitable. For large plants, Steam Air Compressors are preferable. In mechanically heated schools, a power driven pump is the most useful and economical.

To Specify In specifying the Johnson System of Temperature Regulation it is only necessary to write as follows:—"Provide and install complete Johnson System of Automatic Temperature Regulation in the following rooms (name rooms)."

Automatic Humidity Control To maintain the proper Humidity in the Atmosphere so as to effect the best living and working conditions we have perfected special apparatus for supplying the air with moisture to the proper proportion. In principle The Johnson Humidostat is quite similar to the Johnson Thermostat except that it is very sensitive to moisture conditions and is effected by slight humidity changes. The Humidostat operates special devices by means of which the air is supplied with the proper amount of moisture, maintaining the humidity within two per cent. of the desired amount.

The Humidostat is usually located in a room subject to average air conditions. Sometimes it is inserted in a duct through which the air passes.

The cost of equipping a building with our Humidity control is very small as it is generally installed in connection with our system of automatic temperature control, the resultant atmosphere being perfect as regards temperature and humidity.

The moistener or Humidifier may be one of several forms. Where steam is used and the steam is clean a perforated pipe arrangement placed in the air duct is the most perfect and simple humidifier, the steam escaping through small perforations being readily absorbed by the air. The Humidostat controls diaphragm valves on the steam supply and cuts off and lets on the steam as required. These valves are operated by compressed air.

To Specify To specify Humidity Control say, "Furnish Humidity Control using (kind) of Humidifiers."

Note Our Branch Offices include a complete organization of managers, solicitors, engineers, inspectors and mechanics. Any further information regarding the system can be obtained by dropping a card to us.



Hydraulic
Air
Compressor



SHELDONS LIMITED

Head Office and Factory:
GALT, ONTARIO

Toronto Office:
609 Kent Building

AGENTS:

MONTREAL—Ross & Greig, 412 St. James' Street

WINNIPEG—Walker's, Limited, 259 Stanley Street

EDMONTON and CALGARY—Gorman, Clancy & Grindley, Ltd.

VANCOUVER, B.C.—Robert Hamilton & Co., Ltd., Bank of Ottawa Building

Products We are Heating and Ventilating Engineers and Contractors, Manufacturers of the Sheldon Blast System Heating Apparatus, Fans, Engines, and auxiliaries, Forced and Induced Draft Apparatus, Complete Drying Equipment, Dust, Smoke and Shaving Exhausting, etc., etc.



Keith Fans

Sheldons Limited have acquired the Canadian Patent Rights on the "Keith Fan," and are sole owners and manufacturers. This Fan is the ultimate design of the Multivane Type of fan construction, and has been adopted by the British Admiralty, German Navy and the United States Navy.

All the leading Architects and Contractors are now specifying "Keith's."

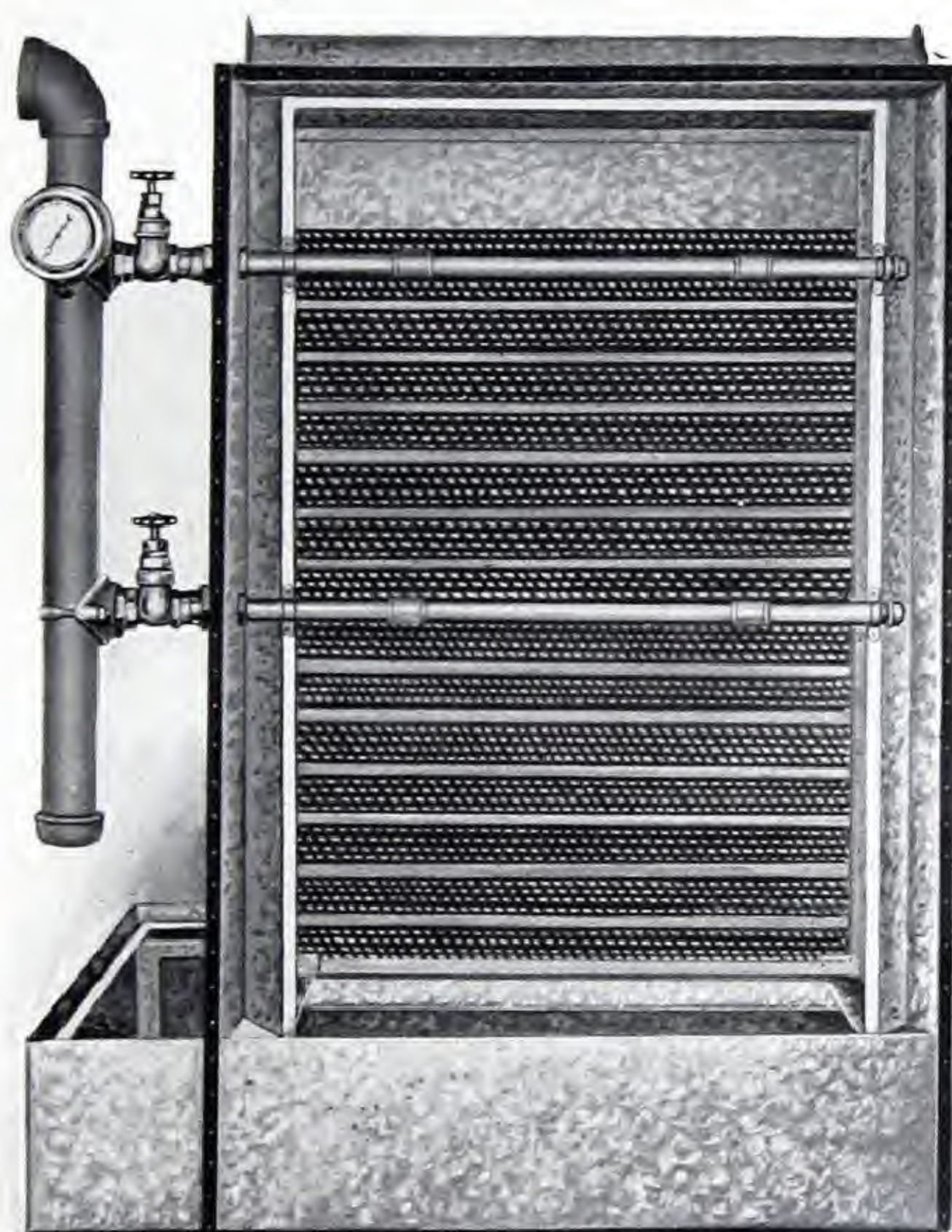
Continued on next page

SHELDONS LIMITED

GALT, ONTARIO

The Eclipse Air Washer

The Donaldson Eclipse Air Washer with Sheldon Automatic Spray heads is meeting with an increased demand throughout Canada on account of its simplicity, ease of operation, and high efficiency as an air cleaning medium. It is equally adaptable with slight alterations for air cooling, and also for humidifying.



Applica- tion

The modern Air Washer has been developed for application to all conditions met in the ventilation of buildings. In any kind of weather a constant supply of **Clean** air at nearly constant relative humidity conditions is assured.

Catalogues

We publish catalogues describing all our products. These contain much valuable information. Write for them.

TUTTLE & BAILEY MFG. COMPANY OF CANADA, LIMITED**BRIDGEBURG, - ONT.**

Product Registers, Ventilators, Grilles, Screens, in Bronze, Brass, Iron and Steel.



Cut showing Registers in new wing of Ontario Parliament Buildings

Specialty We recommend our cast iron goods as they are by far the best especially for durability. Some of our cast iron Registers made by us sixty years ago are still in use. We have been in business nearly seventy years and we believe that no concern in this country enjoys a better reputation nor has been more favored with the confidence of Architects and Contractors than Tuttle & Bailey.

Correspon- Catalogues and information will be gladly sent on request.
dence

THE WATEROUS ENGINE WORKS CO. LTD.

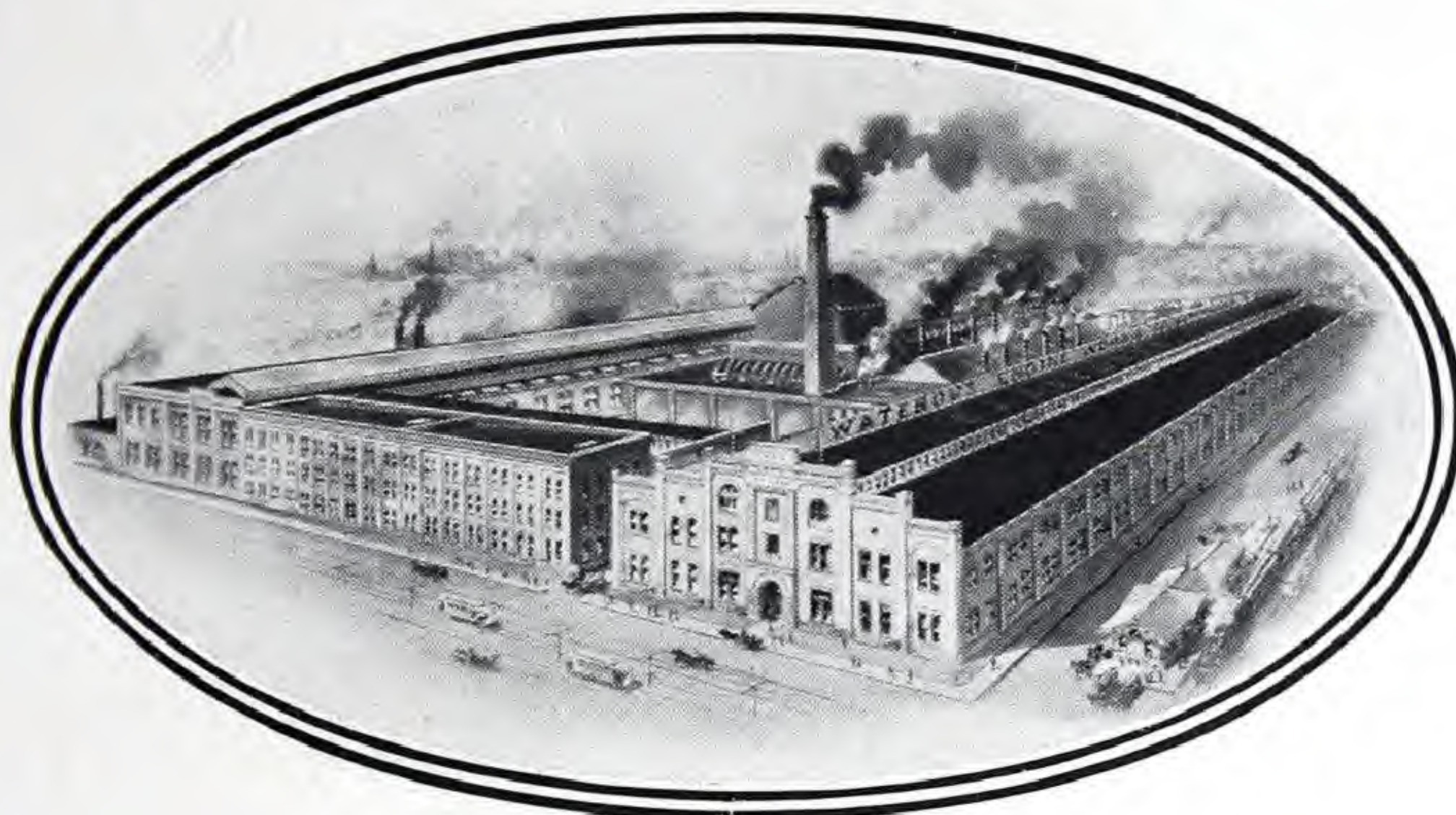
BRANTFORD, CANADA

Branches:

ST. PAUL, MINN.
WINNIPEG, MAN.

Agencies:

VANCOUVER, B.C.
SYDNEY, N.S.W.
SANTIAGO, CHILE.
BRISBANE, QUEENSLAND



On receipt of specifications or sketches we will gladly furnish estimates and suggestions covering the products listed below—

Heating and Power Boilers
Industrial Conveyors and Elevators
High Speed Engines for Electric Light and Power
Refrigerating Plants Complete
Transmission Machinery of all kinds
Steel Plate Work of every type
Air Tanks, Gas Reservoirs, Oil Tanks
Pressure Tanks, Steel Storage Bins
Riveted Steel Pipe, Steel Stacks
Mill Machinery.

Our Shops, amongst the largest in the Dominion, are fully equipped to turn out a high class product only. Our seventy years in business is a guarantee of reliability. We guarantee our workmanship.

Our Technical Department will be pleased to co-operate with you on any installation you have in hand. Any assistance we can give you is yours for the asking.

Catalogues and Bulletins fully describing the machinery we build will be forwarded on request.

SPECIFICATIONS FOR PLUMBING

GENERAL.

The plumber will be required to supply all materials, tools and labor necessary to install in a first-class manner all the fixtures, piping, etc., shown on drawings or mentioned in this specification. He is to furnish fixtures and fittings of the make and quality specified, or equal, and is to carry out the evident intention of these drawings and specifications to the best of his ability.

The contractor must secure and pay for the necessary permits; and provide such material and workmanship as will pass the requirements of the local health officer, with whose regulations he must at all times conform. (In places where there is no plumbing inspection the drains and all piping should be left uncovered until tested and passed by the architect.)

The contractor must take his dimensions off the building, and be responsible for his work fitting to place. He must also hold himself responsible for all damage to the building that may result from his work.

DRAINS.

The trench to be excavated to the bottom at least one foot wider than the diameter of the pipe. The whole length of the trench to be excavated to the proper depth before any pipes are laid. The bottom of the trench to be hollowed out to the correct form and size of the pipe, and to be indented at the sockets so as to admit of the surface of the pipes having an even bearing throughout. The material excavated shall be piled compactly at the side of the trench, and, where the ground is newly made, or soil very wet, the drain to be laid on a prepared foundation of plank or concrete, as may be required.

An arched or other (pipe of larger size) opening must be provided where drain or soil pipe passes wall in order to prevent damage from settlement.

The drain or sewer must be run as direct as possible with a minimum fall of one-quarter inch per foot. All changes in direction to be made with proper fittings, and all connection with branches with one-eighth and one-sixteenth bends.

TILE.

Sewer or drain pipe known as "salt glazed vitrified clay pipe" when properly made is impervious to water (nearly); the glazing will not scale or chip off, and is not affected by most acids or corrosives. "Slip glazed" clay pipe is liable to have the glaze broken, and is then absorbent. Cement pipe has the same defect, though when properly reinforced makes a satisfactory sewer. For drains in or near buildings which must carry sewage, iron or salt glazed vitrified clay pipes are best.

In specifying clay pipe state clearly the quality of pipe acceptable, as:—

"A single fire crack which extends through the entire thickness of a pipe or fitting must not be over two inches long at the spigot end, nor more than one inch long at the hub or socket end, measured in the latter case from the bottom, or shoulder, of said hub or socket. Two or more of such fire cracks, however, at either end of said pipe or special will be cause for rejection.

"A transverse fire crack in a pipe or fitting must not be longer than one-sixth of the circumference of such pipe, nor shall its depth be greater than one-third of the thickness thereof. Two or more such fire cracks will be cause for rejection.

"Irregular lumps or unbroken blisters on the interior surface of a pipe or fitting of sufficient size and number to form an appreciable obstruction to the free flow of sewage will be cause for rejection. A few small, unbroken blisters, not exceeding one-fourth of an inch in height and one or two inches in diameter, upon the inner surface, need not reject a piece."

SOIL PIPES.

The soil pipe to be of cast iron, and run as direct as possible, and to be connected to drain with a cast iron bend, and three feet of pipe extending horizontally from the vertical pipe; all horizontal soil pipes or iron drains to have two 4-inch cleaning screws or approved clean-out fittings, one about 12 inches above and in front of the bend at the basement floor, and the other between the said bend and the outer wall of house, and close to outer wall. All junctions and deviations from straight lines to be effected by proper fittings. Where the main trap on drain is omitted, the iron soil pipe to extend three feet outside the outer wall of house before connecting with the tile drain.

All cast iron pipes and fittings to be sound and smooth castings, free from cracks, sand holes or defect, and of uniform thickness in run of pipe. Pipe including bell or hub to weigh not less than 5½ pounds per foot for 2 inches diameter, 9½ pounds per foot for 3 inches diameter, 13 pounds per foot for 4 inches diameter, and 17 and 20 pounds per foot for 5 and 6 inches diameter.

Joints in cast iron pipes to be made with picked oakum and melted lead. Twelve ounces of pig lead to each joint per inch of pipe diameter, well caulked and gas tight.

LEAD PIPE.

Lead pipe should only be used for short branches of soil pipe or waste pipes, bends and traps, etc., in length for 1½ inch pipe not over 5 feet, 2, 3 and 4 inch pipe in length not over 4, 3 and 2 feet respectively. Lead waste,

soil, flush and vent pipes should be used in weights not less than given in the following table:—

Diameter of Pipe.	Weight per lineal ft.
1¼ inches—flush only	2½ pounds
1½ “	3 “
2 “	4 “
3 “	6 “
4x4½ “	8¾ “

All lead traps and bends must be of the same weight or thickness as the corresponding pipe.

All connections between lead and cast iron pipe to be made by brass ferrules. The joint with the lead pipe to be properly wiped, with the cast iron to be made with oakum and lead, and caulked. Four inch ferrules to weigh not less than 2½ pounds, 3 inch, not less than 1¾ pounds, 2 inch not less than 1½ pounds. Each size must be at least 4 inches long.

TRAPS AND VENTS.

Every fixture must be separately trapped. No traps are to be less than 1½ inches diameter. All traps must have vent pipe: 4 inch traps, 2 inch vent; 2 inch and 1½ inch traps, 1½ inch vents.

Where vent pipes pass through roof the joint at roof must be flashed and made tight with 6 pound sheet lead (or 17 ounce copper).

Where the trap to closets is above the floor, the connection of the same to the soil pipe shall be made of brass and rubber; the floor connection to be made by means of a brass flange, 3-16 inch in thickness, with rubber gasket, and the vent connection by brass coupling and rubber gasket.

LOCAL VENT.

Each closet, urinal or slop sink must have a 3 inch “local” ventilation pipe connected as directly as possible to the nearest heated flue.

Local ventilation pipes to be heavy galvanized iron.

W. I. PIPE.

Hot and cold water pipes to all fixtures to be galvanized iron, butt or lap welded, with proper galvanized iron fittings, threads full and well cut. All pipe and fittings to be clean and free from burr, scale or rust before installing. Pipe cement to be used in as small quantities as consistent with good workmanship. W. I. piping, where exposed, to have approved C. I. floor and ceiling plates, except in unfinished attic, etc.

NICKEL-PLATED PIPE.

All exposed water, waste and vent pipe at fixtures, except 4 inch C. I. soil pipe, to be (seamless) brass tubing heavily nickel plated, with suitable N. P. brass fittings.

All N. P. pipes to be fitted with N. P. brass (spun, cast) floor or wall plates of approved pattern where necessary.

FIXTURES.

Specify manufacturer, style, type (catalogue number), size, and so on, or equal in the opinion of the architect. Give sufficient description to completely identify the fixtures and fittings desired.

GUARANTEE.

The contractor shall guarantee in writing for a term of _____ years from date of completion of his work all fixtures, pipe and fittings, or such materials as may have been supplied or installed by him, to be and remain for said term of years in first-class condition. He also guarantees to make all necessary repairs, or replace defective material, fixtures or work for said term if such becomes necessary in the opinion of the architect.

DRAINS AND DRAIN PIPE.

CAST IRON PIPE.

Cast iron pipes suitable for drainage work is made in two grades, known to the trade as standard and as extra heavy, respectively. The pipes are cast in lengths of 5 feet each, exclusive of the hubs and are of the average weights per lineal foot stated in the following table:—

Inside Diameter of Pipe in Inches.	Average Weights per Lineal Foot, including Hubs.	
	Standard	Extra Heavy
2 inches	3½ lbs.	5½ lbs.
3 inches	4½ lbs.	9½ lbs.
4 inches	6½ lbs.	13 lbs.
5 inches	8½ lbs.	17 lbs.
6 inches	10½ lbs.	20 lbs.
7 inches	13 lbs.	27 lbs.
8 inches	18 lbs.	33½ lbs.
10 inches	25 lbs.	44 lbs.
12 inches	30 lbs.	54 lbs.
15 inches	45 lbs.	..

As would be expected, there is a great difference between the same grades of pipe turned out by different manufacturers. Some pipe is rough, coarse looking, full of mould marks and under weight, while other pipe is full weight, compact, of close texture, smooth and in every way to be preferred. The latter kind of pipe is less likely to crack when being handled or cut, and less likely to develop sand holes than the poorer quality, and will consequently prove more economical to handle. The use of standard cast iron pipe is prohibited entirely in some cities, while in others its use is permitted, providing it will stand a water test. In cities where no restrictions are placed on the use of standard weight cast iron pipe it will be found perfectly safe to use in buildings not over three storeys in height, providing the system is filled with water upon completion and made perfectly

Distance of Deflectors Below Ceiling.

Distance of deflectors from ceilings or bottom of joists to be not less than 3 inches nor more than 10 inches. (6 to 8 inches is preferable.)

Detailed Locations.

Sprinklers to be placed throughout premises, including basement and lofts, under stairs, inside elevator wells, in belt, cable, pipe, gear and pulley boxes, inside small enclosures, such as drying and heating boxes, tenter and dry room enclosures, chutes, conveyor trunks and all cupboards and closets unless they have tops entirely open and are so located that sprinklers can spray therein. Sprinklers not to be omitted in any room merely because it is damp, wet, or of fireproof construction.

Special instructions to be obtained relative to placing sprinklers inside show windows, boxed machines, metal air ducts, ventilators and concealed spaces, and under large shelves, benches, tables, overhead storage racks, over dynamos and switch boards, platforms and similar water sheds.

Protection of Vertical Shafts.

In vertical shafts having inflammable sides, a sprinkler to be provided within shaft for each 200 square feet of the inflammable surface. Such sprinklers to be installed at each floor when practicable and always when shaft is trapped. Inflammable shafts even if lined with plaster or metal require sprinklers as above.

Distance from Walls.

The distance from wall or partition not to exceed one-half the distance between sprinklers in the same direction.

Partitions.

A line of sprinklers to be run on each side of partition. Cutting holes through a partition to allow sprinklers on one side thereof to distribute water to the other side is not effectual. This rule applies to both solid and slatted partitions.

Mill Construction.

Under mill ceiling (smooth solid plank and timber construction, 6 to 12 feet bays) one line of sprinklers should be placed in centre of each bay and distance between the sprinklers on each line not to exceed the following:

- 8 feet in 12 feet bays.
- 9 feet in 11 feet bays.
- 10 feet in 10 feet bays.
- 11 feet in 9 feet bays.
- 12 feet in 6 to 8 feet bays.

Measurements to be taken from centre to centre of timbers.

Joisted Ceilings.

Under joisted ceiling, open finished, distance between sprinklers not to exceed 8 feet at right angles with joists or 10 feet parallel with joists.

Smooth Sheathed or Plastered Ceilings.

Under smooth sheathed or plastered ceilings, in bays 6 to 12 feet wide (Measurement to be taken from centre to centre of timber, girder or other projection or support forming the bay) one line of sprinklers to be placed in centre of each bay, and distance between the sprinklers on each line not to exceed the following: 8 feet in 12 feet bays; 9 feet in 11 feet bays; 10 feet in 6 to 10 feet bays. Bays in excess of 12 feet width and less than 23 feet width to contain at least two lines of sprinklers; bays 23 feet in width or over to have the lines therein not over 10 feet apart. In bays in excess of 12 feet width, not more than 100 square feet ceiling area to be allotted any one sprinkler.

Pitched Roofs.

Under a pitched roof sloping more steeply than 1 foot in 3, one line of sprinklers to be located in peak of roof, and sprinklers on either side to be spaced according to above requirements. Distance between sprinklers to be measured on a line parallel with roof. Where the roof meets the floor line there should be a line of sprinklers placed not over 3½ feet from where roof timbers meet floor.

Two lines of sprinklers not more than 2½ feet distant each way from the peak of roof, measured on a line with the roof, may be used in lieu of one line of sprinklers located in peak of roof.

Staggered Spacing.

Under open finish, joisted construction floors, decks and roofs, the sprinklers should be "staggered" spaced so that heads will be opposite a point half way between sprinklers on adjacent lines, the end heads on alternate lines to be not more than two feet from wall or partition.

This regulation does not except sprinklers within a bay, whether on one, two or more lines. Adjacent sprinklers to be so staggered as not to distribute water into the same joist channel ways.

PIPE SIZES.

1. General Schedule.

In no case should the number of sprinklers on a given size pipe exceed the following:

Size of Pipe.	Maximum No. of Sprinklers Allowed.
¾-inch.	1 sprinkler
1 " "	2 sprinklers
1¼ " "	3 " "
1½ " "	5 " "
2 " "	10 " "
2½ " "	20 " "
3 " "	36 " "
3½ " "	55 " "
4 " "	80 " "
5 " "	140 " "
6 " "	200 " "

A Complete Guide to Testing Plumbing. Domestic Engineering Company, Chicago.
Sanitary Engineering of Buildings, W. P. Gerhard. Domestic Engineering Company, Chicago.
Sanitation in the Modern Home, Pierce. Domestic Engineering Company, Chicago.
Modern Plumbing Illustrated, Wm. T. Comstock, New York.
Roughing in House Drains. Domestic Engineering Company, Chicago.

THE B.O.T. MANUFACTURING CO. LTD.

B.O.T. BUILDING

159-161 Richmond Street West, Toronto

Product	Manufacturers and Specialists in High Grade Water Closet Outfits.
Woodwork	The B.O.T. Woodwork is made with a hidden lock dove-tail Joint. The B.O.T. Seats are made with a spiral lock dove-tail. These joints make cracking and splitting impossible.
Fittings	The B.O.T. Fittings, include the B.O.T. Improved Ballcock, practically noiseless, 10 ounce Copper Lining with tinned bottom, and the B.O.T. Patented Fool Proof Lever.
Bowls	The B. O. T. Bowls have a straight Expanded Leg, where all others contract. This does away with clogged bowls.
Guarantee	The B.O.T. Guarantee is for Five Years. The reason why we can do this is that we are closet specialists and devote all our time to the one article.



The Trade Mark that stands for the above guarantee.

SAMPLE SPECIFICATIONS

We would recommend for different classes of buildings.

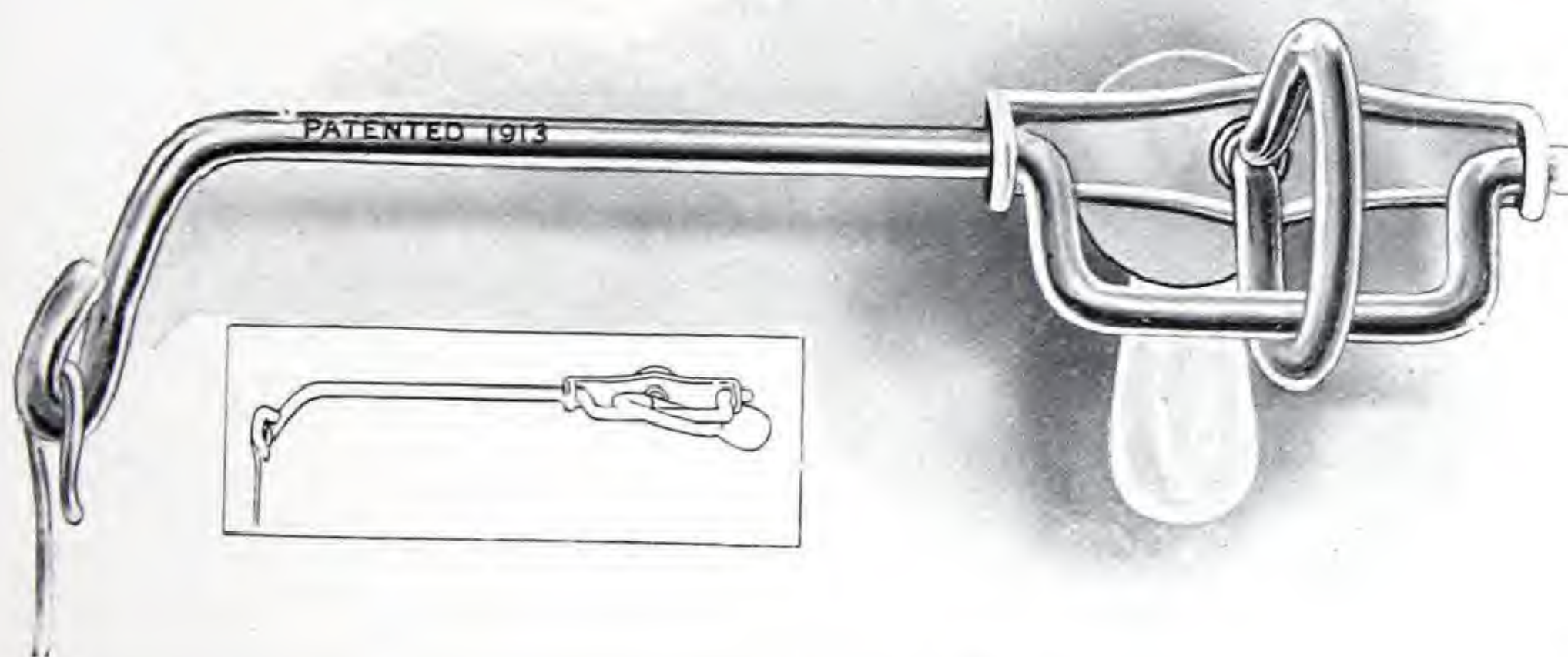
Offices, Churches, Large Residences	Plate A. 3½, B.O.T. Golden Quarter Sawed Oak Tank; Plate 205 Seat and Cover; No. 375, B.O.T. Bowl. Complete List Price, \$28.50 OR Plate A. 5½, Early English Tank; Plate A207 Seat and Cover; No. 375, B.O.T. Bowl. List Price, \$29.35
Factories and Schools	(Low Tank Outfit) Plate A.6, Straight Cut Oak; Seat with Self Raising Ball Hinges. No. 375, B.O.T. Bowl. List Price, \$27.70 NOTE—Plumber to screw down Top of the above mentioned A.6 Tank. (High Tank Outfit) B.O.T. 8 gallon High Tank; Straight Cut Oak, Seat with Self-Raising Ball Hinges. No. 375, B.O.T. Bowl. List Price, \$24.00
Apartment Houses	Plate A.6½, Straight Cut Oak, Golden, Antique or Natural; Plate 203 Seat and Cover; No. 375, B.O.T. Bowl. List Price, \$24.00 Same as above, Plate 6½, in Imitation Mahogany. List Price, \$25.65
Small Houses	Plate A.6, Golden Oak, Antique or Natural; Plate 202 Seat and Cover; No. 375, B.O.T. Bowl. List Price, \$22.50
Show Rooms	Our new Show Rooms are now complete and we heartily invite anyone who is interested in High Grade Water Closet Construction to come and see the latest and most up-to-date Closet on the Market. Let one of our salesmen explain, and show you, why we can Guarantee The B.O.T. Outfit for 5 years.



PLATE A.3½
GOLDEN ¼ CUT OAK.



PLATE A.2—China Tank with Genuine Mahogany
Seat and Cover. List Price \$37.90.



NEW
(PATENTED)
B.O.T. LEVER.

Strength,
Simplicity,
and
Perfection.



CONSTRUCTION OF A B.O.T BOWL.

The B.O.T. Outfit is made in forty different styles and finishes. We will match any color wood to suit bathroom trimmings.

Write for Catalogue and Price List or have one of our Representatives call and see you, or better still, come personally and see us.

THE JAMES MORRISON BRASS MANUFACTURING CO. LIMITED

93 - 97 ADELAIDE STREET WEST
TORONTO, = ONT.

STEAM GOODS



MORRISON Steam Specialties and Brass Goods are offered to the building trade with an absolute guarantee of satisfaction. We can supply you with all the valves, pipe, fittings, traps, boiler mountings, gauges, injectors, and other accessories of the heating system and power house, at prices consistent with high grade goods. For over thirty years we have been the largest manufacturers of this class of goods in Canada. A position which has been maintained by careful selection of material, first class design and workmanship and rigorous factory tests, in other words, an honest product.

PLUMBING GOODS AND FIXTURES



MORRISON Plumbing Goods and Fixtures include high grade equipment of every kind for the complete installation of bath rooms and lavatories for residences, hospitals, and public buildings.

In particular we call your attention to our Simplex "Elgin" and "Astoria" closets. The Elgin is a good quality wash down closet for all round service. The Simplex is a Syphon-Jet closet of somewhat better grade. And the Astoria is a Syphon-Jet closet with extra large waterseal—no better fixture than the Astoria is made.

All are pure white solid china products, covered with a beautiful white glaze, which is put on the prepared body and then subjected in the kiln to a very high temperature. The result is a surface of pure glass but with physical properties so similar to those of the china body that an absolute guarantee can be given that "crazing" will not occur.

Our fixtures have been designed throughout with simplicity and graceful outline, free from all awkwardness and crevices in which dirt might accumulate. Practically noiseless, fitted with our improved elevated ball cock, renewable seats, and many other distinctive features.

ELECTRIC FIXTURES



MORRISON electric fixtures combine modern, distinctive design with efficient illumination.

Particularly, are we well equipped to supply the entire fixture requirements for large buildings. In this connection we are always glad to consult with architects, builders, and contractors, and to extend to them the knowledge and experience of many years has given us.

CLUFF MANUFACTURING CO. LIMITED

65-75 Sterling Road

TORONTO, - ONT.

Products High Grade Closet Tanks.

Illustration The cut on opposite page, illustrating the No. 5 Vitro tank, portrays, as does all other cuts made of it, only a general likeness, but, unlike most objects, justice to its real outline has not been done.

Details Ideal simplicity, the easy beautiful lines are all in evidence when the tank itself is seen.

No irregularities, dust collectors or ornamentations are to be seen or are necessary to make it attractive, and with its elegant snow-white enamel finish, one is impressed and satisfied that in buying the No. 5 Vitro tank that not only is it ornamental, but it represents the every demanded virtues of sanitation—a one-piece, absolutely impervious (vitreous), indefinitely durable and “No Trouble” tank.

Such is Vitro and more.

More Vitro Tanks were sold during 1913, than any other style in the World. Though while this took seven years to accomplish, a mutual feeling of conservatism is expressive because it took step by step to make Vitro tanks what they now are—an absolutely “No Trouble” closet tank.

VITRO GUARANTEE

Guarantee A new Vitro Tank will be given to replace one that at any time proves defective from either material or workmanship.

CLUFF MANUFACTURING COMPANY, LIMITED

65 - 75 Sterling Road

TORONTO = = ONTARIO

No. 5 Vitro Tank

Over 150,000 **Vitro** tanks now in use,
with an ever constantly growing demand.

See opposite page for No. 5 **Vitro**
tank in combination with syphon wash-
down reverse trap bowl.

Continued on next page

CLUFF MANUFACTURING COMPANY, LIMITED

65 - 75 Sterling Road

TORONTO

=

-

ONTARIO



Plate C 51—The Montrose Syphon Washdown Reverse Trap Closet with No. 5 White Finish **VitrO** Tank, special reinforced Birch Mahogany post hinge seat and cover, with cast brass floor flange and rubber gasket N. P. closet bolts.

SPECIFICATION FOR GAS PIPING FOR CITY GAS

GENERAL.

In piping a building for gas, it makes some difference whether the gas supplied is manufactured, water or coal gas, or whether it is natural gas, machine-made air gas, or finally, acetylene.

The following specification is suitable for manufactured city gas.

GAS SERVICE.

To be of wrought-iron pipe, of ample size; to be run into the building with pitch back to street main, where possible; or else to be provided with siphon, or drip pipe and emptying plug, where service must necessarily be graded toward the house.

Gas service to be protected from frost wherever necessarily exposed.

HOUSE GAS PIPES.

To be of a good quality of welded wrought-iron pipe, preferably galvanized.

(Steel pipe, being somewhat brittle, is not so good; lead gas pipes should not be permitted.)

(Cast-iron pipe is sometimes used for services larger than 2½ or 3 inches in diameter.)

All pipe to be examined and blown into, before being used, to guard against obstructions.

PIPE FITTINGS.

To be of malleable iron, preferably beaded fittings; fittings to be selected and examined for sandholes; galvanized fittings to be preferred.

In making turns or bends, use fittings in preference to bending the pipe.

JOINTS.

To be screw joints. Use red and white lead mixed, or boiled linseed oil in joints, or approved pipe-joint graphite.

Use precaution not to get any lead on the inside of joints.

No gas-fitters' cement to be used on joints under any circumstances.

The practice of rusting up the pipes by filling them with water is bad, and should be prohibited.

Unions should be avoided, particularly in concealed gas pipings; if required, use ground-joint union fittings. (Brass seated unions.)

No washer joints should be permitted.

All joints must be made absolutely tight.

SHUT-OFFS.

Use the best quality heavy brass work. Round-way, ground-key, lever cocks are preferable to valves, as they indicate at once by position of lever, whether the pipe line is open or shut.

Valves, if used, should be soft-seat brass valves.

Iron valves are not to be permitted, as they quickly corrode from the action of the gas.

HOOKS, STRAPS AND CLIPS.

All pipes to be well fastened by hooks, straps, or clips of wrought iron—not of cast iron.

Use screws for fastening pipe hold-fasts.

No bent nails or common hooks should be used to hold gas pipes in position.

CUTTING OF FLOOR JOISTS.

This should never be done by the gasfitter. The carpenter to do all the cutting, and beams should not be notched, bored, or cut more than (25 per cent.) of their depth, and never farther away from wall or bearing, supporting the beams, than two feet.

SIZES OF HOUSE PIPES.

No pipe to be less than three-eighths inch; it is better to make 0.5 inch the minimum size.

In determining sizes of pipes, follow table for sizes of house pipes for gas lighting, and table for sizes of gas pipes for gas ranges and gas grates.

Make all piping ample in size.

ARRANGEMENT OF GAS PIPING.

No risers to be placed in outside walls.

No riser to be less than ¾ inch.

A number of separate risers is desirable; these should be connected at the top, for a better circulation of the gas, and also to avoid undue variation in the gas pressure.

Another method of accomplishing this is to have separate risers for each floor.

For gas grates in fireplaces, run entirely separate risers, one for each group of vertical fireplaces.

Provide a separate riser for the gas cooking range in the kitchen.

Provide a separate riser for the gas water heater, also for the gas-using laundry appliances.

Sometimes a separate meter for gas used in cooking or heating is desirable.

Larger risers to be kept exposed in closets; smaller pipes to be tested before being covered up or plastered over.

Running lines in floors to be kept accessible by floor boards, secured with brass screws instead of nails.

Run all branches for side or wall fixtures up from below, and do not drop them from above (except in the cellar, or where unavoidable).

Place no running gas lines under tiled floors or hearths.

Run no gas pipes through flues.

Supply drop fixtures from branches, taken off from side or top or running lines; never drop the branch from the bottom of a line.

All horizontal gas pipes to be run with sufficient fall back to the riser; the horizontal run at cellar ceilings to have a fall toward the gas meter.

All long horizontal runs between floor beams to be well supported to avoid sagging and traps.

Avoid all condensation of gas in pockets or depressions.

Keep gas pipes and risers away from pipes or flues of the heating apparatus.

GAS OUTLETS.

Place no gas outlets behind doors or too near window trims or curtains.

Place outlets for side-wall fixtures at proper height, and centre fixtures in the exact centre of the room.

At completion of gas piping, check off all outlets from plans.

Make all nipples and drops plumb, and of proper length for the fixtures, not to project more than 1 inch from surface.

TEST OF GAS-PIPE SYSTEM.

The entire gas piping, when completed, and before plastering is begun, to be tested by a gasfitter with an air pump and a mercury gauge (22 inches long); spring gauges are not reliable.

Test the pipe system under a pressure equivalent to a column of mercury in gauge, 18 inches high (9 pounds pressure).

The mercury in the gauge must stand one hour without indicating a greater fall than $\frac{1}{4}$ inch per hour.

All leaks and defects, which the test reveals, to be searched for with ether or by the application of soapsuds; the same to be made good by gasfitter.

No split pipe or broken fitting, or fitting having sandholes, to be repaired with cement or solder, but must be replaced at once by good pipe or fitting and the defective piece taken away from the building.

In large buildings, test gas piping in sections.

After the test, have a number of capped outlets opened slowly, on each of the floors, to make sure by the falling of the mercury in the gauge that the entire piping has been under the test, and that no parts are accidentally or intentionally disconnected.

After test, leave all outlets capped tightly.

When alterations in the gas are made, or additional burners are put in, test the altered work in the same manner as in the first test.

Before the gas fixtures are hung or put up, the gasfitter is to repeat the test in the presence of the contractor for the gas fixtures so as to demonstrate to him the tightness of the entire piping.

(This leaves the fixture man responsible for any leaks discovered when the gas is first turned on at fixtures.)

After fixtures are hung, the contractor for the fixtures to apply another pressure test, with three inches of mercury in the gauge.

Sizes of Gas Pipes, Maximum Lengths and Maximum Number of Burners (at 6 cubic feet each).

Diameter of Pipes Inches	Maximum Length Feet	Maximum No. of Lights
$\frac{3}{8}$	20	2
$\frac{1}{2}$	30	3
$\frac{3}{4}$	40	6
1	60	10
$1\frac{1}{4}$	70	15
$1\frac{1}{2}$	100	30
2	150	60

Sizes of Gas Pipes for Gates and Cooking Ranges.

Diam. of Pipe Inches	Maximum Length Feet	
$\frac{1}{2}$	100	One cooking burner or 1 gas grate.
$\frac{3}{4}$	100	Two cooking burners or 2 gas grates.
1	100	Gas cooking stove with 4 burners or 4 gas grates.
$1\frac{1}{4}$	100	Larger gas ranges or 7 gas grates.

Gas grates and burners of cooking ranges are assumed to have a consumption not exceeding 35 cubic feet per hour. For a larger consumption increase the size of pipe supplying grate or range.

SPECIFICATIONS FOR GAS LIGHTING FIXTURES

SIZE OF TUBING.

Stems for chandeliers and pendants up to 6 burners must have not less than $\frac{1}{4}$ inch iron pipe, and from 6 to 12 burners not less than $\frac{3}{8}$ inch iron pipe.

Tubing for chandelier arms, where of brass or copper, must not be made of less than $\frac{3}{8}$ inch tubing up to 24 inches spread, 7-16 inch tubing up to 30 inches spread, and $\frac{1}{2}$ inch tubing up to 36 inches spread.

Straight arms or pendants must have not smaller than $\frac{1}{8}$ inch iron pipe in arms.

CONSTRUCTION.

All fixtures must be made so that at all traps there is provision for letting out water of condensation.

All joints must be gas tight and must be tested before leaving the factory to withstand a pressure equal to 5 inches of mercury.

The architect reserves the right to have fixtures taken apart, and to refuse acceptance if they are not constructed in accordance with good workmanship.

THE CONSUMERS' GAS COMPANY, OF TORONTO

12-14 Adelaide St. West, TORONTO

Telephone Main 1933

Head Office:

19 Toronto Street, TORONTO, ONT.



Products

Combination Gas and Electric Fixtures and straight Gas fixtures built according to architects' drawings and specifications. Special designs submitted to Architect for approval. Combination Gas and Electric Fixtures are the order of the day. The many conditions surrounding the problem of illumination and the many advantages both systems of lighting have, it is advantageous to install both in all classes of buildings, homes and apartments.

Expert Advice

There is one important department in our office of which we want every architect to know and make use of. That is our consultation and designing department. We want every architect in Toronto to feel quite free in consulting with our experts, and if you have any special problems in illumination to solve, or data relative to the amount of light required for any given space, then let us know. No charge is made for this service. Our consultation department telephone number is Adelaide 2180. Ask switchboard for number 18.

Design

It is customary in designing the interiors of large residences, halls, libraries and public buildings to make the lighting fixtures part of the interior decorations. We will gladly submit special designs for such work in consultation with the architect. Our fixtures, as the illustrations show, are designed upon strictly architectural lines.

Modern Methods

A home fitted with combination Gas and Electric Fixtures is at once—the ideal, because it adds value to the building, as well as tone to the surroundings. A home becomes more modern in every respect, and will be found a better renting and a better selling proposition in every way. The light you want—when you want it, is possible with the **Combination Idea**. Modern Gas lighting is in a field by itself. It is now enjoying a high place in the illuminating world.

Co-operation

We are fully equipped, ready and willing to co-operate with every live architect, in every possible way to extend his business—and incidentally our own.



Continued on next page

THE CONSUMERS' GAS COMPANY

Head Office:
19 Toronto Street
TORONTO

Salesroom:
12-14 Adelaide St., West

Architects' Attention

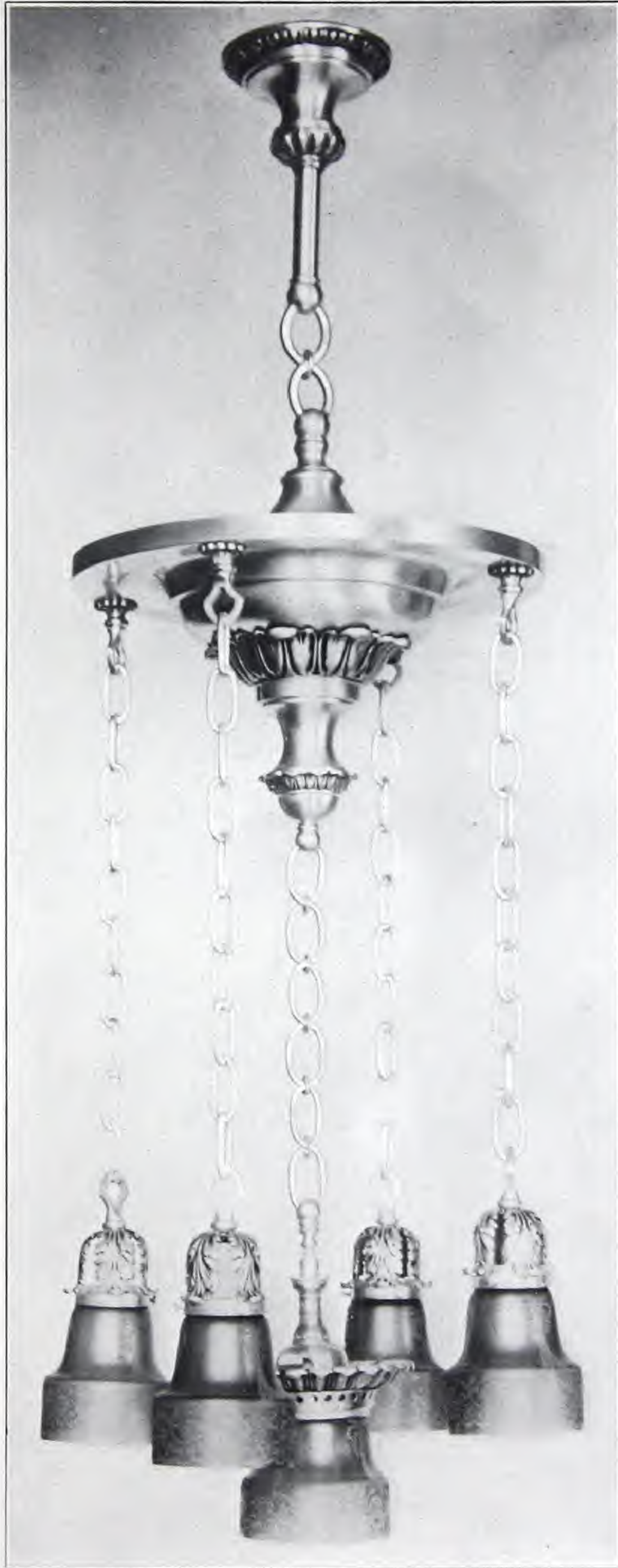
We want every Architect in the City of Toronto to come in and see our new lines of Combination Gas and Electric Fixtures.

We have something entirely new and something that will convince the most exacting that gas fixtures can be made equal to and often above that made for electric use only. The effects obtainable are simply beautiful and once seen, are appreciated.

We have an illustrated folder showing about eighteen different types of combination Gas and Electric Fixtures, copy of which folder will be gladly mailed to any one interested on request.

Piping

We respectfully ask architects to specify that all installations of gas piping be according to the specifications as laid down by the best Gas Engineers. Copy of piping specifications will be mailed on request. We will inspect piping contracts to see if specifications are carried out (Toronto Buildings only) FREE.



ELECTRIC WIRING AND APPARATUS

GENERAL.

Wires must not be of a smaller size than No. 14 B. and S. gauge, except as allowed for fixture work and pendant cord.

For tie wire only approved insulated wire must be used.

Wires must be so spliced or joined as to be both mechanically and electrically secure without solder.

Stranded wires (except in flexible cords) must be soldered before being fastened under clamps or binding screws, and whether stranded or solid, when they have a conductivity greater than that of No. 8 B. and S. gauge copper wire, they must be soldered into lugs for all terminal connections, except where an approved solderless terminal connector is used.

Wires must be separated from contact with walls, floors, timbers or partitions through which they may pass by tubes of incombustible, non-absorptive, insulating material, such as glass or porcelain, excepting at outlets, where approved flexible tubing is required.

Conductors, when not protected by approved conduit, moulding or armoring, and where liable to come in contact with gas or water pipes or other conducting material, must be separated therefrom, by some continuous and firmly fixed non-conductor, creating a permanent separation.

Conductors must be so arranged in wet places that an air space will be left between them and pipes or other obstructions in crossing, and must be run in such a way that they cannot come in contact with such obstructions accidentally, and wires must not be run in elevator shafts where the potential exceeds 650 volts, and below this potential they must be run in approved conduit, or armoured cable must be employed.

Must be rigidly supported on incombustible, non-absorptive insulators, which will separate the wires from each other, and from the surface wired over, in accordance with the following table:—

Voltage.	Distance from surface	Distance between wires
10 to 300.....	½ inch	2½ inches
301 to 650.....	1 inch	4 inches
651 to 2500.....	2 inches	6 inches
2501 to 3500.....	3 inches	9 inches

Must not be "dead-ended" at a rosette socket or receptacle, unless the last support is within twelve inches of the same.

Wires of No. 8 B. and S. gauge or over must not be supported on split knobs.

Unused ends of insulated conductors, such as those at switch and fixture outlets, must not be left uninsulated.

In dark rooms, lavatories, basements and places where a person would be liable to receive a shock when handling electric fittings, the shells of sockets, pendant switches, plugs and receptacles must be of porcelain or other approved insulating material, unless the fixtures or sockets, etc., are out of reach or controlled by wall switches.

SERVICES AND SERVICE METERS.

An approved switch and cut-out must be placed on all service wires, whether these be overhead or underground. Such switch and cut-out must be located inside the building at the nearest accessible point to the place where the service wires enter, and they must, except where enclosed sealed service fuses are used, be arranged to cut off the entire current from the circuits which they control.

Service cut-outs must always be enclosed in an approved iron or steel box and sealed under the control of the supply authority.

Not more than one service of the same potential must be run from overhead into any building from the same system, except as hereinafter provided.

Where the difference of potential is between 650 and 3,500 volts, and where services from overhead lines are brought into buildings, the following requirements must be observed:—

1. The point where overhead wires enter conduit must not, where practicable, be less than 20 feet from the ground.

2. Conductors must be lead sheathed, and the insulation must, in no case, be of a grade lower than that required for 3,500 volts.

3. Conduit and sheathing must be well bonded, and permanently and effectually grounded.

4. Must, where wires issue from sheathing, be protected from moisture by a pot-head, or other approved device.

5. Service wires must be so located that they cannot be reached from any window or balcony, or other points wherefrom any unauthorized persons might be able to touch them; or otherwise they must be properly protected, so that the same object will be attained.

Must not be so arranged as to shunt the current through a building around any catch-box.

Where an underground service enters a building through tubes, the tubes must be tightly closed at outlets with asphaltum or other non-conductor, to prevent gases from entering the building through such channels.

LOW POTENTIAL WORK.

Wires, when entering cabinets, must be protected by approved bushings, which must tightly fit the holes in the box and be well secured in place.

When wires are run open across the face of joists, wall studs or other timbers and where they might be exposed to mechanical injury, such as in basements or other places not remote from such injury, they must be attached by their insulating supports to the under-side of a wooden strip, not less than one-half inch in thickness, and not less than four inches in width. Instead of running boards, guard strips on each side of, and close to, the wires will be accepted. These strips are to be not less than seven-eighths of an inch in thickness, and at least as high as the insulators.

Protection on side walls must extend not less than five feet from the floor, and must

consist of substantial boxing, retaining an air space of not less than one inch around the conductors, closed at the top (the wires passing through bushed holes), or approved metal conduit or pipe of equivalent strength must be used.

When metal conduit or pipe is used, the insulation of each wire must be reinforced by approved flexible tubing extending from the insulator next below the pipe to the one next above it. The two or more wires of a circuit, each with its flexible tubing (when required), must be placed within the same metal pipe. Special permission for deviation from this last requirement may be granted in the case of direct-current circuits.

In damp places, wooden boxing may be preferable, because of the precautions which would be necessary to secure proper insulation if metal pipe were used. With this exception, however, metal piping is considered preferable to the wooden boxing; it is especially suitable for the protection of wires near belts, pulleys, etc.

INTERIOR CONDUIT WORK.

(Rigid and Flexible.)

No rigid conduit tube having an internal diameter of less than five-eighths of an inch must be used. Measurement must be taken inside the conduit.

Must be continuous from outlet to outlet or to junction boxes or cabinets, and the conduit must properly enter, and be secured to, all fittings, and the entire system must be mechanically secured in position.

Except in the case of flexible steel conduit of the built-in type, must be first installed as a complete conduit system, without the conductors.

Metal conduits, where they enter junction boxes, and at all outlets, etc., must be provided with approved bushings or fastening plates, fitted so as to protect wires from abrasion, except when such protection is obtained by the use of approved nipples, properly fitted in boxes or devices.

Pull-in and junction boxes must always be installed in such a manner as to be accessible.

All elbows or bends must be so made that neither the conduit nor the lining of same will be injured.

Wires used in conduit must have an approved rubber insulating covering, and must, within the conduit tubing, be without splices or tape.

In all sizes larger than No. 12 B. and S. gauge, wires must be stranded.

Conductors in vertical conduit risers must be supported within the conduit system in accordance with the following table:—

No. 14 to 0 every 100 feet.

No. 00 to 0000 every 80 feet.

No. 0000 to 350,000 c.m. every 60 feet.

350,000 c.m. to 500,000 c.m. every 50 feet.

500,000 c.m. to 750,000 c.m. every 40 feet.

750,000 c.m. every 35 feet.

The following methods of supporting cables are recommended:—

A turn of 90 degrees in the conduit system will constitute a satisfactory support.

Junction boxes, in which insulating supports of approved type must be installed and secured in a satisfactory manner, may be inserted in the conduit system at the required intervals, so as to withstand the weight of the conductors attached thereto. Such boxes must be provided with proper covers.

Cables may be supported, in approved junction boxes, on two or more insulating supports so placed that the conductors will be deflected at an angle of not less than 90 degrees, and carried a distance of not less than twice the diameter of the cable from their vertical position. Cables so suspended may be additionally secured to these insulators by tie wires.

Must have the two or more wires of a circuit drawn in the same conduit.

The same conduit must not contain more than four two-wire, or three three-wire circuits of the same system, except by special permission of the Inspection Department having jurisdiction, and must never contain circuits of different systems.

FIRE ALARM SYSTEMS

LOCATION AND INSTALLATION.

Must be installed throughout premises. In basements, lofts, elevator walls, and under stairs.

Every room where partition extend to ceiling should be provided with at least one detector.

Place at least one detector at top of openings for elevators.

Large rooms or sub-divided floors having large open ceiling should be figured at—one 5 foot detector per 500 sq. ft. floor space—or one 7 foot detector per 700 sq. ft. floor space.

Each detector must be securely fastened CLOSE to the ceiling and supported by means, entirely independent of the attachment to the wires of the system.

MANUAL ALARMS.

At least one manual alarm box should be installed near the exit in a conspicuous and easily accessible place on each floor. Large floors and long hallways should be provided with sufficient manual alarm boxes to ensure quick and easy access in case of fire.

GONGS.

Electric gongs of sufficient size and approved make should be installed to give full and sufficient warning to all inmates of the protected property, whether awake or asleep, as well as attract the passerby's attention. At least one approved weather-proof gong not less than 6 inches in diameter shall be located

on the outside of property, placed as near as possible or directly over the entrance to the indicator board.

INDICATOR BOARDS.

An Indicator Board, provided with drops or shutters for showing the location of the fire, should be placed at a point easy of access in every protected warehouse, factory and office building. This Indicator Board should be equipped with the necessary electrical conveniences for testing out the lines both inside and out, testing the battery and the gongs. A Voltmeter to measure the current supply, and a brigade-call to automatically control the sending of signals to the recording device at the central fire-station. This Indicator Board should also be supplied with a properly connected Galvanoscope adjusted to instantly show any existing ground or break in the system. Consultation should be had with the Fire Chief and local Underwriters in the matter of locating the Indicator Board in public and semi-public buildings.

HOME PROTECTION.

Properly developed automatic fire alarm systems for private homes and clubs. These

private "self-contained" installations are not usually connected with the firehall, but they may be, and would be, of more service and afford better fire protection if so installed.

FIRE-STATION SET.

Apparatus should be provided at the central fire-station for automatically receiving and recording all operations of each individual system, whether test or fire alarm signals. This method is practiced in the cities of London, Glasgow, Edinburgh, Dublin, Belfast, Aberdeen, Sheffield, Manchester, Liverpool, Birmingham, Leeds, Montreal, Ottawa, Toronto, Winnipeg, Vancouver, Sydney, Auckland, Cape Town, Johannesburg, Los Angeles, and many other important cities.

WIRING.

The wiring should conform with the approved practice and comply with the rules and regulations adopted by the Fire Underwriters Board. We recommend that all inside conductors be carried in steel conduit, and that all outside wires, between the risk and the firehall, be carried, wherever possible, in underground conduit or aerial cables.

ELECTRIC LIGHTING PLANT

Small isolated electric generating plants may be divided into systems:

1. Direct running installations.
2. Storage battery installations.
3. Automatically operated plants.

As to which of these systems should be installed depends on the individual requirements and conditions.

1. DIRECT RUNNING SETS.

Consist of an engine (or water wheel), a generator and switchboard, and are suitable for installations where the light is not required except when the engine is running, and then for certain hours, and at a fairly steady load. It is, of course, necessary to have some one to start and stop the plant, but while it is running, an engine properly designed for electric lighting should require no attention. This system is suitable for contractors' plants, cinematograph theatres, street lighting, mining plants, factory plants and large hotels where there is a load all day; and two plants can be installed and run alternately. Sets driven by water power are always run on this system, as there is very little disadvantage in its running continuously.

2. STORAGE BATTERY SETS.

Consist of engine, dynamo, storage battery and switchboard. The engine is run during the day to charge the batteries, and the lights are run from the batteries at night.

Storage batteries should be put in large enough to carry the lights required for at least two or three nights, as otherwise should the man who attends to the plant be absent for a day, the light will fail. They also should be charged carefully at the right rate and must not be discharged below 1.8 volts

per cell. In this charging and discharging there is a loss of 40 to 50 per cent. of the power, and as the depreciation in the battery is twice or even three times as much as on the engine and dynamo, this system should not be employed for large installations unless special conditions absolutely demand it.

3. AUTOMATIC PLANTS.

There are many so called automatic plants on the market, but the majority of them are storage battery plants which charge the battery automatically when the engine has been started by hand, and care should be taken in selecting a good plant, as otherwise poor regulation of the engine will considerably shorten the life of the battery.

There is another automatic plant which is really a direct running set, but has a small battery which only has to carry about 10 per cent. of the load before the engine starts, and when more than the load is switched on or the battery becomes partially exhausted, it is used to start up the engine automatically by using the dynamo as a motor to turn the engine, and a patent attachment is employed by means of which the engine starts firing directly it attains a fair speed. When the engine starts running it lights the lamps direct from the dynamo and recharges the battery. When the lamps are switched off, the engine automatically stops itself, so that it is only necessary to go to the engine room at any convenient time to refill the gasoline and lubricating oil tanks and clean down the engine. By this automatic running the size of the battery is reduced to the minimum, the 40 or 50 per cent. loss in charging and discharging saved, and the continuous 24 hour service maintained.

CONDUITS COMPANY LIMITED.

Head Office: TORONTO

Branch: MONTREAL

Sole makers the leading brands of Conduits.



“Galvaduct”

The white conduit with the enamelled interior—surface smooth and clean—coated with pure dense metallic zinc which, not being porous, cannot absorb injurious substance such as acids, or oils. Raceway clean, smooth and glossy, facilitating easy insertion of wires—The Original—the Best—Patented.



“Loricated ”

The best known and most extensively used enamelled conduit on the market—flexible, corrosion resisting coating—soft annealed pipe—sharp cut threads—clean interior. Has no equal in the enamelled type of conduit, and is second only to “Galvaduct.”

Correspondence solicited. Information or booklets on our line on request

R. A. LISTER & CO. Limited

58-60 Stewart Street

WINNIPEG

TORONTO

ST. JOHN, N.B.

Telephone—Adelaide 700

Electric Lighting and Pumping Installations, Etc.

Engine or Water Driven

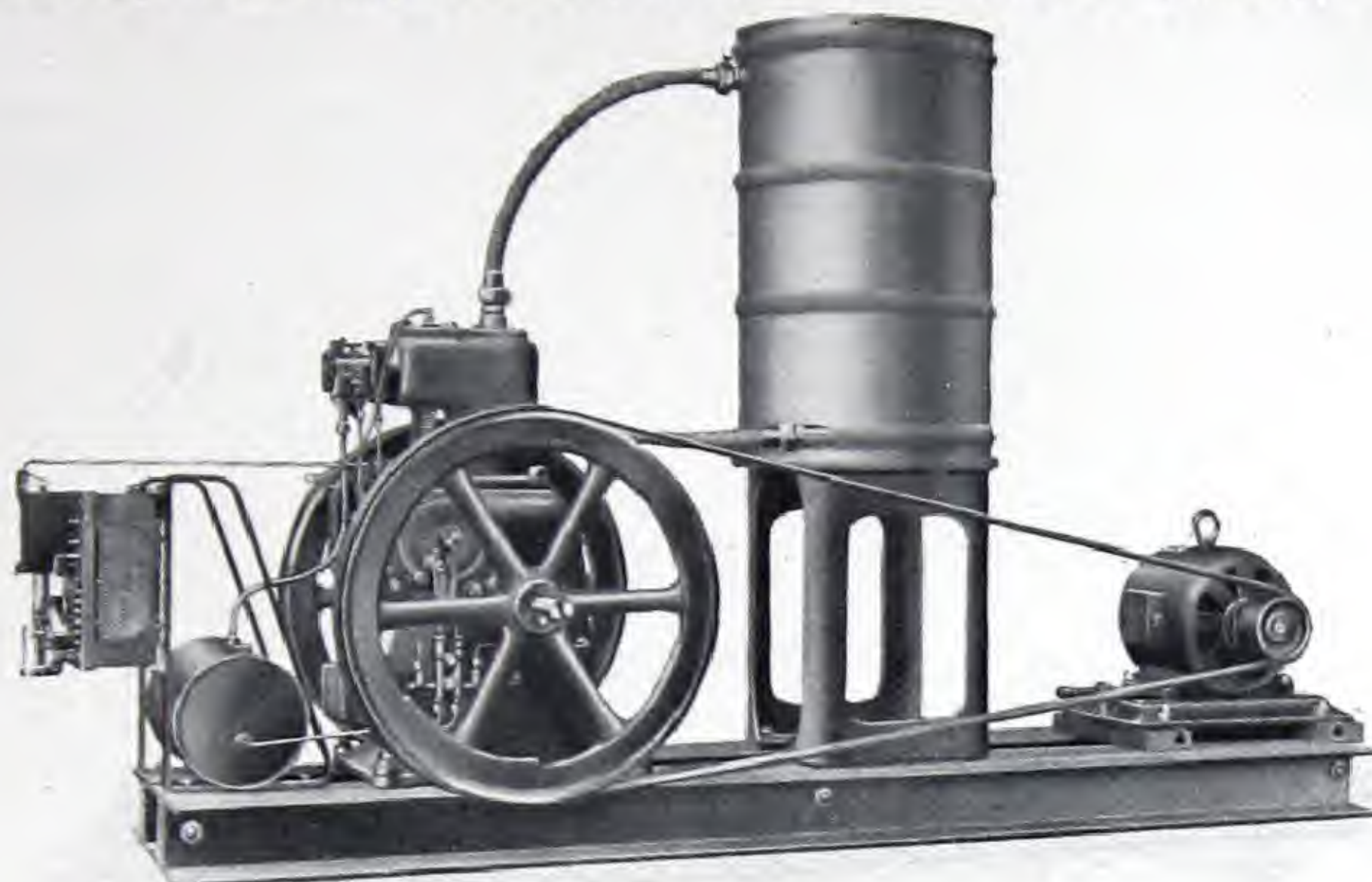
Products	Electric lighting and generating plants for country houses, summer houses, churches, hotels, factories, street lighting, small towns and picture theatres. Storage batteries, motors, appliances and supplies. Gasoline engines, gas engines, oil engines and pumps of all descriptions.
"Lister" Internal Combustion Engines	Are of substantial construction and manufactured with the idea of turning out the best engine on the market, not the cheapest. They are fitted with automatic forced lubrication, Bosch high tension magneto ignition and "Admiralty" phosphor bronze bearings throughout.
"Lister-Bruston" Automatic Lighting System	Is described on next page and is the most efficient and cheapest electric lighting system for any installations over $\frac{1}{2}$ K.W. capacity where a storage battery is necessary. There are over 700 of these plants running in Great Britain, a large number of which are in the country houses of the nobility, and amongst other places where this plant is giving satisfaction are, the Royal Residence for Ascot, Belvedere Fort, the Royal Church at Craithie, Balmoral, the house of Mr. Asquith, Prime Minister, at Sutton Veney, the Royal Engineers Officers' Mess at Shoeburyness, while in this country among the 100 plants in operation are seven for the Canadian Bank of Commerce and two for the township of Shawville, Quebec. Names of private owners for reference given on application. A water pumping system can be supplied to work automatically the pump starting and stopping itself as required.
"Lister" Storage Plants	Consisting of "Lister" engine or water wheel, generator, switchboard and storage battery can be supplied up to any capacity, but for more than $\frac{1}{2}$ K.W. the "Lister-Bruston" system is recommended.
"Lister" Electric Plants	Consisting of "Lister" engine or water wheel, generator and switchboard, suitable for installations where load is about constant and where light is not needed except at certain hours, such as street lighting, picture theatres, mines, contractors plants.
Pump	Pumping plants for water service or fire fighting installations planned and quoted for.
Services	R. A. Lister & Co., Limited, have had years of experience in isolated electric plant work and will be pleased to advise and submit estimates and plans for lighting and pumping installations for private houses, hotels, picture theatres, small towns, etc., free of charge.

Continued on next page

“LISTER-BRUSTON”

AUTOMATIC ELECTRIC GENERATING PLANTS

For
Country Houses, Hotels, Churches, Small Towns, Etc.



SPECIFICATION

Engine	“Lister” low speed vertical gas or gasoline engine specially designed for running long periods without attention, fitted with special automatic forced lubrication, Bosch high tension magneto ignition, phosphor bronze bearings throughout, necessary cooling tank, metallic hose water connections, standard exhaust connections, expansion chamber and muffler, patent valve release, magnetic governor and controller.	
Dynamo	Patent open protected type dynamo fitted with box carbon brushes and automatic ring lubrication, sliding bedplate and fly wheel pulley. The whole of the above mounted on one girder frame and suitable for standing on floor and running without special foundations or bolting down.	
Switchboard	Enamelled slate switchboard containing the necessary instruments, patent relay apparatus, safety circuit breaker and fuse complete with battery.	
Battery	“Chloride” battery consisting of cells and all accessories of the type and of ampere hours capacity and suitable for lighting about 10% of peak load before engine starts and starting up engine automatically.	
Capacities Made	Made in the following sizes with single cylinder engines, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2, $2\frac{1}{2}$ Kilowatts, twin cylinder engines $3\frac{1}{2}$, 5, 6, Kilowatts, and four cylinder 12, 18, 24 Kilowatts continuous output in 57 and 110 volts. Other voltages not stocked but can be delivered in eight weeks.	
Accommodation Necessary	Plant is quite self-contained and ready to connect to house mains and can be installed in the following sized engine rooms. Can be placed in basement or outhouse.	
	$\frac{1}{2}$ K.W. 9'6" x 5'6"	$\frac{3}{4}$ and 1 K.W. 13'0" x 6'0"
	$1\frac{1}{2}$, 2 and $2\frac{1}{2}$ K.W. 14'6" x 6'0"	$3\frac{1}{2}$, 5 and 6 K.W. 8'0" x 12'0"
	12 K.W. 12'0" x 18'0"	18 K.W. 12'0" x 24'0"
	24 K.W. 12'0" x 30'0"	

AUTOMATIC FIRE ALARM PROTECTION

MAY-OATWAY FIRE ALARMS, LIMITED

Toronto - Winnipeg - Vancouver

General Information

The time to put out a fire is when it starts. The fires that burned Chicago and Baltimore could each have been extinguished with one pail of water if taken in time. The great fire that destroyed millions of dollars of property in Toronto started in a small way. Had its starting been detected and announced in its incipient stages it would have been extinguished with but little loss or damage.

Inflamable Buildings

It is the mission of the May-Oatway Fire Alarms to give due and timely warning of the starting of a fire; the importance of this is obvious. Our Cities, Towns and Villages are full of structures which are really "Fire Traps." The wonder is that more of them do not burn. Even the average home, as constructed and unprotected, is an invitation to destruction of both life and property. The Toronto fire that destroyed a Mother and two children could have been easily extinguished had its starting been discovered and announced by a self-contained May-Oatway Fire Alarm System. Every guest would have escaped from the ill-fated Woodbine Hotel had May-Oatway detectors and gongs been on duty to discover and automatically announce the starting of the fire.

Automatic Detection

The only absolutely safe and reliable provision for detecting and reporting incipient fires is the Automatic May-Oatway Fire Alarm System. It is constantly on guard watching all parts of the building or buildings simultaneously. A fire may start in the attic while a watchman is in the basement, or a fire may start in the basement, while the watchman is on the third floor. The May-Oatway Automatic Fire Alarm System detects and announces the starting of a fire in any part of the property. It instantly shows the location of the fire and simultaneously notifies the inmates, the immediate neighbours and the Fire-brigade. It never sleeps, never tires, never fails. It is always on duty throughout the entire building and can always be relied upon to give timely warning before the fire has gained headway.

A few of the many hundred May-Oatway Installations

Sir William Macdonald.....	Montreal.	Parliament Buildings.....	Ottawa.
Canadian Pacific Railway.....	Montreal.	Model School.....	Vancouver.
Ogilvie Flour Mills.....	Montreal.	Harrods' Stores.....	London, Eng.
Ogilvie Flour Mills.....	Winnipeg.	J. & P. Coats, Ltd.....	Paisley.
G. F. Stephens & Co.....	Winnipeg.	J. Templeton & Co.....	Glasgow.
J. H. Ashdown & Co.....	Calgary.	Edinburgh Evening News....	Edinburgh.
Royal Crown Soap Works.....	Calgary.	Sheffield Daily Telegram....	Sheffield.
Royal Crown Soap Works.....	Winnipeg.	Liverpool Courier.....	Liverpool.
Wood Vallance & Co.....	Hamilton.	Manchester Guardian.....	Manchester.
Maclean Publishing Co.....	Toronto.	Daily Telegraph.....	Sydney.
Mason & Risch.....	Toronto.	T. Eaton Co.....	Winnipeg and Toronto

AUTOMATIC FIRE ALARM PROTECTION**MAY-OATWAY FIRE ALARMS, LIMITED****Toronto****-****Winnipeg****Vancouver****Approved by****FIRE OFFICES COMMITTEE, GREAT BRITAIN****Underwriters Laboratories (inc.) U.S.A.****Australian Board of Fire Underwriters****Canadian Board of Fire Underwriters****New Zealand Board of Fire Underwriters**

- What It Does** The May-Oatway System is automatic in all its phases. It follows normal changes of temperature and raises or lowers its operating point accordingly. It allows a fire 25 deg. start, and no more. Whenever the fire has raised the temperature 25 deg. whether from zero or 100 Fah., the Brigade are called, inmates are warned, and the position of the outbreak is shown automatically.
- Self-Adjusting Automatic May-Oatway Detectors** There is no mystery about the May-Oatway Detector; its action depends entirely upon natural laws and is inevitable. There are no springs to weaken, no solution to melt, no tubes to puncture, dent or choke, and no delicate adjustments to make. The detector uses a large surface to collect heat because speed and certainty cannot be had without it. Gradual changes in temperature do not change the relations of the metals and do not cause alarms to be given. A blaze causes a sudden rise of temperature, which is promptly reported by the Self-adjusting Automatic May-Oatway Detector which has proven its reliability and efficiency in every instance during the past ten years.
- Position Indicator** The May-Oatway Indicator (placed in the building protected) shows the location of the fire. No matter where the smoke comes forth, the Indicator-board automatically shows where the fire is. It has proven an unerring guide to inmates and Brigades in locating quickly the fire.
- Automatic-ally Calls the Brigade** Simultaneously with the alarm at the Fire, the Brigade is called automatically. The inmates of a protected building do not need to run outside to send in an alarm; they can turn their attention fully to fighting the fire knowing that the May-Oatway System has automatically called the Fire Brigade simultaneously with the giving of the alarm at the building which is on fire.
- Self-Contained Installations** In places outside Brigade areas, such as mining or milling plants, homesteads, country stores, etc., the May-Oatway system is arranged to give the alarm on gongs powerful enough to be heard for half a mile in any direction. This notification, taking place when the fire has raised the temperature only 25 deg. is so timely that anybody with the simplest appliances can put it out, and the same degree of protection cannot be got in any other way.
- Home Protection** Why should the home be so utterly unprotected against the ravages of fire? Why should people be so thoughtless as to neglect the protection of their lives and their treasures when the installation of a Self-Contained Automatic May-Oatway Fire Alarm System would give notice to the inmates, whether sleeping or awake, at the same time automatically notifying the entire neighbourhood by the ringing of an outside gong.

UNDERWRITER'S ELECTRIC CO.

41 - 43 St. Urbain St.

MONTREAL

ILLUMINATING ENGINEERS

Business

We are Engineers and Contractors for all kinds of **Residential, Commercial and Industrial Lighting.**

Repair

We guarantee satisfaction in repairing generators and motors.

Telephone Bells and Annunciators

We have a complete line of Telephones, Bells, and Annunciators.

Policy

Our policy is "nothing but the best." In order to assure our patrons of satisfactory work, we are always willing to give them the benefits of our knowledge in consulting with them regarding any proposed work.

We earnestly solicit a trial that we may prove beyond dispute that our work is of the best which skill and experience can produce.

CONDULETS SPECIFICATIONS

Condulets Must be Guaranteed to Stand the Following Test in Accordance with the Following Specifications

GALVANIZING TEST REQUIRED FOR CONDULETS.

ELECTRO PLATING.

The body of the condulet shall be thoroughly cleaned, pickled, and then electroplated with a coating of zinc. This coating must adhere firmly without scaling or blistering, to every part of the casting. Any specimen must be capable of withstanding the following test: A sample shall be immersed in a standard solution of copper sulphate for one minute, and then removed and immediately given a thoroughly washing in water and wiped dry. This process shall then be repeated. If, after the fourth immersion, there should be a copper colored deposit on the sample or the zinc should have been removed, the lot from which the sample was taken shall be rejected. The standard solution of copper sulphate crystals in water. This solution shall have a specific gravity of 1.185 at 70° Fahr., and during the test the temperature of the solution shall not be less than 60° Fahr. nor more than 70°.

(Note:—The above test shall be taken as applying to the outside surfaces of the condulet casting only. Any such copper deposits forming on the inside surfaces shall not be taken as evidence of failure to comply with the specifications.)

INTERIOR FINISH.

To prevent corrosion and insure a smooth surface, all condulets shall be thoroughly cleaned and pickled on the inside and finished with a heavy coat of insulating enamel.

FINISH OF COVERS.

All condulet covers of metal shall stand the above required test.

All Condulet Covers, either porcelain or metal, shall be arranged with self-retaining screw washers, so that the holding screws will always be in their proper place (which is in the cover.)



Type V C

Condulet Installations

Look Best and Last Longest

There's a Complete Line of Condulets for Each form of Conduit Outlet Requirement

Write for Catalog No. 1000



Type Q H C



Type F S C



Type N



Type S



Type Z C



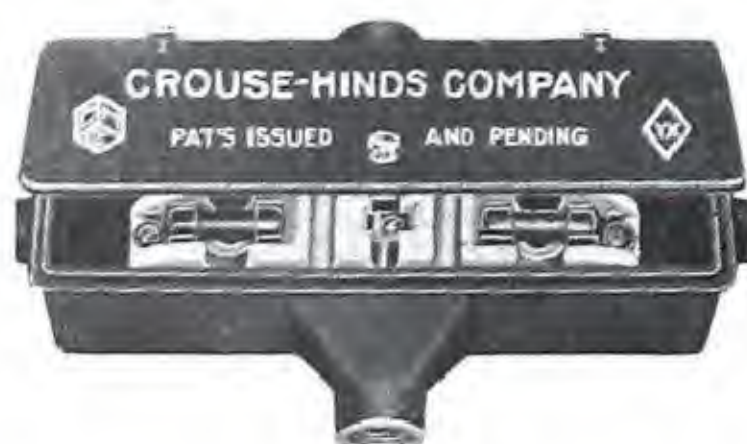
Type R



Type F F



Type W



Type Y X



Type A



Type B



Type J



Type P



Type C



CROUSE-HINDS COMPANY OF CANADA
LIMITED



Main Office and Works:

Toronto, Ontario, Canada

GENERAL PANEL BOARD SPECIFICATIONS

MATERIAL.

The base is to consist of the highest grade of black Monson slate, free from flaws or metallic veins. All current carrying parts are to be made of the best grade of hard drawn copper of ninety-eight (98) per cent. conductivity.

FINISH.

The slate is to be furnished with a rubbed oil finish. All exposed metal parts are to be finished in polished copper, carefully lacquered, except on contact surfaces.

SPACINGS.

All current carrying parts are to be spaced in accordance with the latest requirements of the National Board of Fire Underwriters.

CURRENT DENSITY.

All current carrying parts are to be based upon a maximum current density of one thousand (1,000) amperes per square inch cross-section.

CIRCUIT CONNECTIONS.

Two to two (2-2) wire Panel Boards are to be connected in the regular manner, adjacent poles of adjoining circuits to be of the same polarity, but fed by separate bars. Three to two (3-2) wire Panel Boards, both for one hundred and twenty-five (125) and two hundred and fifty (250) volts, are to be connected for the Edison three wire system; that is, each branch circuit is to have one pole connected to one of the two outside busbars. Three to two (3-2) wire Panel Boards are to be connected so that adjacent poles of adjoining circuits are of the same polarity, but fed by separate bars.

CAPACITIES.

Fuse terminals, branch circuits and branch circuits with knife switches, are to be of thirty (30) amperes capacity. Snap switch circuits are to be of ten (10) amperes capacity. Mains on all two to two (2-2) wire, one hundred and twenty-five (125) volt Panel Boards are to be figured at six (6) amperes per circuit. All two to two (2-2) wire, two hundred and fifty (250) volt, and three to two (3-2) wire, one hundred and twenty-five (125) volt and two hundred and fifty (250) volt, Panel Boards are to be figured at three (3) amperes per circuit.

FUSE ARRANGEMENT.

Fuses are to be placed between the switch and the outgoing circuit; so that the switch blades and fuses are dead when the switch is open.

CIRCUIT STRIPS.

Branch circuit strips are to be made of one-half ($\frac{1}{2}$) inch by one-sixteenth ($\frac{1}{16}$) inch copper, formed up in such a manner as to make direct connections to the main busbars without the use of pillars, thus reducing the number of part sand contact joints to a minimum.

CIRCUIT SWITCHES.

Knife switches are to be of thirty (30) amperes capacity and thirty (30) amperes spacing, equipped with substantial composition handles into which the blades are to be cast. Contact clips and hinge standards are each to be formed from one piece of one-half ($\frac{1}{2}$) inch by number sixteen (16) gauge copper. The contact clips are to be flared at the top to insure proper entrance of the blades. The blades are to be of substantial design and made of one-half ($\frac{1}{2}$) inch by number thirteen (13) gauge copper. Hinge joints are to be held under compression by spring washers, insuring perfect contact. If Snap switches are furnished, they are to be of the indicating type, ten (10) amperes capacity, designed especially for these Panel Boards, and are to present a neat and attractive appearance. The outer case is to be made of black composition and to cover the entire mechanism and connections.

MAIN SWITCHES.

Main switches are to be of substantial design and construction, and are to be regularly mounted at the bottom of the Panel Board. The capacities of the main connections for various Panel Boards should be given in the schedule where Panel Boards are listed.

SLATE FRAMES.

Slate frames are to be made of oiled Monson slate, one-half ($\frac{1}{2}$) inch thick, and to telescope the Panel Board; therefore the outside dimensions of a slate frame are to be one (1) inch greater than those of the Panel Board with which it is used. Slate frames are to be drilled for circuit wires and slotted for main wires, and are to be held in position by adjustable corner irons.

DOOR LININGS.

Door linings are to be made of one-quarter ($\frac{1}{4}$) inch Monson slate, of the same size as the Panel Board, and are to be drilled for fastening screws.

STEEL BOXES.

Mounting.

For mounting either surface or flush with the wall.

Material.

Number 10 U.S. standard gauge sheet steel (.140").

Construction.

Formed from one piece of sheet steel overlapped and riveted at corners. The box is to be unlined. The box is to be of proper size to allow a three (3) inch wiring compartment or gutter between the sides of the box and slate frame surrounding the panel.

Finish.

Boxes are painted both inside and outside with two coats of P. & B. compound.



Type A Panel

Panels and Cabinets

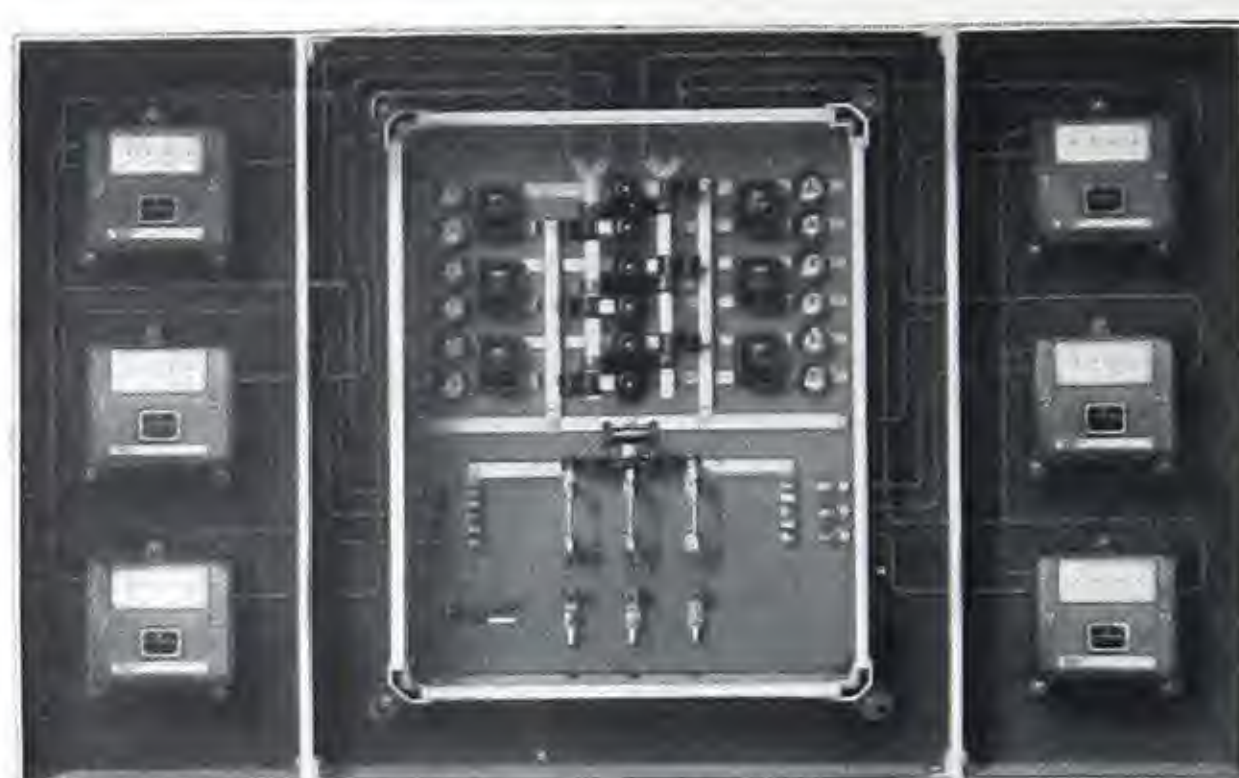
Complete Line of Standard
Material Always on Hand
Send us your Specifications and
we will Make Drawing Free
Write for Catalog No. 1



Type D Panel



Type F Panel



Multimer (Metering) Panel



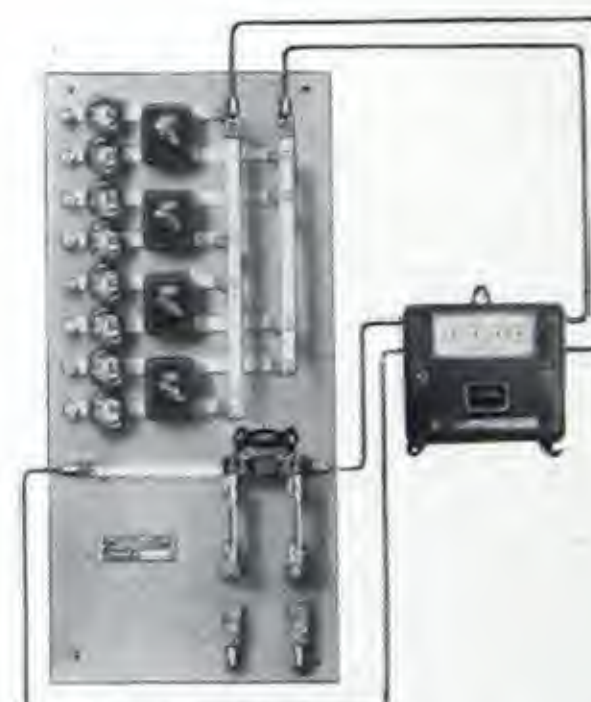
Type H Panel



Type B N Cabinet



Convertible Panel



Panel with Meter Loops



Type A K Cabinet



CROUSE-HINDS COMPANY OF CANADA
LIMITED



Main Office and Works:

Toronto, Ontario, Canada

NOTES ON METALS USED FOR ORNAMENTAL WORK

SPECIFICATION CLAUSES

DRAWINGS, ETC.

Drawings for ornamental metal work should be full size sketches, shaded, at least in part, to bring out the intention of the designer as clearly as possible. Modelled work should be executed in wax, clay, or other suitable medium, and submitted for the architect's approval before patterns are made.

QUALITY.

It will generally be sufficient to specify the material required, as wrought iron, bronze, brass, etc. The quality may safely be left to any reputable manufacturer. Specify such parts of the design as are to be made of solid sections, and where hollow or structural shapes may be used. Also where castings are permitted or required and the material to be used. Casting must be sound and evidence of moulds not (particularly) noticeable.

FABRICATION.

As with quality, methods of manufacture may be left to the firm supplying the work, but it may be well to give general directions as to what parts are to be welded, tensioned, riveted, etc., and to specify that rivets and screws must not be obtrusively visible. The design will generally indicate the position of collars, ties, etc., but in gate work it is often essential to rivet the work before the collars are put on.

FIXING.

In all fixed work the specification should state clearly whether the price is to include fixing or not; and if so, whether mason's work, making good, etc., is to be done by contractor. Also specify if scaffolding and other appliances are to be provided and erected by this contractor. Specify the kind of workmanship required and how work is to be run;

lead, cement. Specify all necessary supports, stays, anchors, and method of fastening to walls.

SHEET METAL.

Where the design includes leaves, rosettes, shields, and so on, of sheet metal, specify material and weight, also the method of fastening same, as welded or riveted.

GATES.

Specify sections of framing, horizontal and vertical bars at least. Also mention whether price is to include lock, bolt, hinges, stops, catches, etc. Specify the make or type of hardware required and quality.

STAIR WORK.

Specify the case rail, where nosings are thin or of marble, specify method of fixing. When lead is used for this purpose, the driving home is liable to crack the stone.

WINDOWS AND DOOR GRILLES.

It is recommended that measurements be taken from the building. Grilles should be so fixed as to be removable, or such as to not prevent cleaning of windows.

FINISH.

The number of different finishes at the disposal of the architect and their quality will depend upon the manufacturer's facilities. Specifications should cover this point and also include a statement of requirements in the matter of permanence of finish, both for outside and inside work. Specify that protection must be given to the work during shipment and until finally accepted by the architect; specify parts to be painted. Damage received during transit or erection must be made good by the contractor.

SPECIFICATIONS FOR JAIL CELLS

DIMENSIONS OF CELL.

There will be one cell, or two or more joined together. Each cell to be 54 or 60 inches wide, 84 inches deep from front to rear, and 84 inches high, set in either a block or a row.

CONSTRUCTION OF CELL.

The top, front and back of cells, unless otherwise noted, including the cell doors, to be of lattice work: the partitions between cells and sides of $\frac{1}{8}$ inch Bessemer solid prison steel plate. (The top of cells or any other part can be of plate instead of lattice work.)

The cells to be fitted with plate bottoms, or without bottoms (to fasten to cement, stone or wood floor.)

PLATE WORK.

The Bessemer prison steel plate will be $\frac{1}{8}$ inch thick. All edges of each plate to be planed true and square: all plates will be perfectly straight and free from twists or buckles. All joints between plates will be butted close and will be battened by 3 inch batten strips; all corners will be thoroughly and securely put together with $1\frac{3}{4}$ inch x $\frac{3}{16}$ inch steel angles. All steel batten strips and

corner angles will be securely rivetted to the plate work with round head steel rivets, spaced and staggered to give the greatest strength.

LATTICE WORK.

The lattice work to be made of $1\frac{3}{4}$ inch by $\frac{3}{16}$ inch Bessemer prison steel flat bars crossing at right angles and spaced so as to form openings 4 inches x 4 inches. Around each lattice section will be a steel angle frame as described above. Each vertical and horizontal bar to be securely rivetted at each intersection; also each end of said bars to be securely rivetted to the steel angles forming the frame, with round head rivets.

CELL DOORS.

Each cell to be provided with a Bessemer prison steel lattice door, the opening to be about 6 feet 8 inches x 26 inches for a cell 7 feet high, constructed in all respects as specified under "Lattice Work" to be hung on heavy forged steel hinges, securely rivetted to the frame around the door and to the frame of the lattice forming the door opening.

PROTECTION PLATE.

Around the lock shall be securely rivetted a steel armor plate about 24 inches by 24 inches, making it impossible for the prisoners to reach the lock or tamper with it.

FOOD OPENING.

Each cell door shall have a food opening about 4 inches by $9\frac{1}{2}$ inches.

STEEL BUNKS.

In each cell there will be (one or) two bunks, 2 feet wide by 6 feet long, hung above each other. The bunks to be made with steel angle frames to which will be secured a lattice bottom made of steel bands crossing each other at right angles and interwoven. The bunks to be hung on hinges and so arranged as to turn up against the side of the cell when not in use.

PAINTING.

The cell work and fixtures to be painted one coat of the best metallic paint before shipping.

WORKMANSHIP AND MATERIAL, ETC.

All material shall be new and of the best quality used for such purposes, and the workmanship throughout shall be the best. These specifications will be considered as a part of the contract and will be binding on the manufacturer to make the cell work as specified.

CONSTRUCTION.

Cells shall be rivetted up in full sections, which will go through any ordinary door. Before shipping each cell shall be set up complete in the factory to insure the perfect fitting of all parts. While in place on the floor all sections to be carefully marked to show just how they are put together. A Blue Print of cells showing how sections are marked to be sent with each shipment, also the necessary rivets, so that an ordinary mechanic can erect the cells. All special fitting to be done at the factory and no special tools shall be required for erection.

METAL STORE FRONTS

METAL STORE FRONTS.

There are now on the market a number of different "systems" for glazing and finishing store fronts in metal—usually copper. The glazing bars are drawn from cold rolled spring copper and polished. This takes on a beautiful statuary bronze color on exposure, and is durable, requiring no further rubbing. The glazing bars are usually made so that the screws are accessible in such a way that the glass cannot be removed from the outside.

The same finish, by many companies, is carried out over the whole store front, and the copper and other metals such as brass, gun metal, etc.—are produced for the purpose in sheets, mouldings, beads, castings, etc.

Very often this form of construction is used with what is called "ventilated sills," to which it is readily applicable, the object being to prevent the formation of frost on the window.

Theoretically, cold, dry air circulating in a show window will reduce the humidity and prevent the moisture from condensing on the glass surface and forming frost.

In general, the above theory is true, but several conditions enter into it which must be observed before the results are successful.

Firstly—The windows must be enclosed from the store proper, and this enclosure must be made air tight (absolutely). The floor, ceiling and partition should be double, with paper between. If glass is used in this partition, it should be puttied and the entering door should be constructed similarly to an ice box door, have two rabbets and have rubber weather strips around.

Secondly—The air from the outside must enter the window near the edges and at the surface of the glass, so that the circulation is greatest at the glass surface.

Thirdly—A sufficient amount of outside air must be admitted, so that the humidity and temperature inside the window approaches that of the outside.

The fact that air in a show window is cold does not necessarily mean that it is dry. It is found during fall weather when a show window is filled with cold, damp air (above freezing), and a sudden fall of temperature strikes the glass, the moist air within the show window will frost before the outside air has time to enter and by circulation take up this moisture. But by continuing cold the frost will disappear and the windows stay clear.

AIKENHEAD ARCHITECTURAL METAL WORKS

364-370 Richmond Street West

TORONTO - - - ONT.

Product Iron Stairs and Fire Escapes, Marquise and Covered Ways, Balconies, steel Collapsible Gates, Railing, Fire Door Fittings.



Illustration We have here illustrated gates and grilles installed at the Bank of Toronto, Queen Street and Logan, Toronto.
Architects, Messrs. Chapman & McGiffin, Toronto.

Service We are equipped with the most modern machinery, and so can take care of any size contract, and guarantee first-class work and prompt shipments.

Estimates We would be pleased to co-operate with Architects and others in the preparation of special designs for anything in our line. We would gladly forward any information required.

CANADIAN ORNAMENTAL IRON CO. LTD.

E. J. LEA - MANAGER

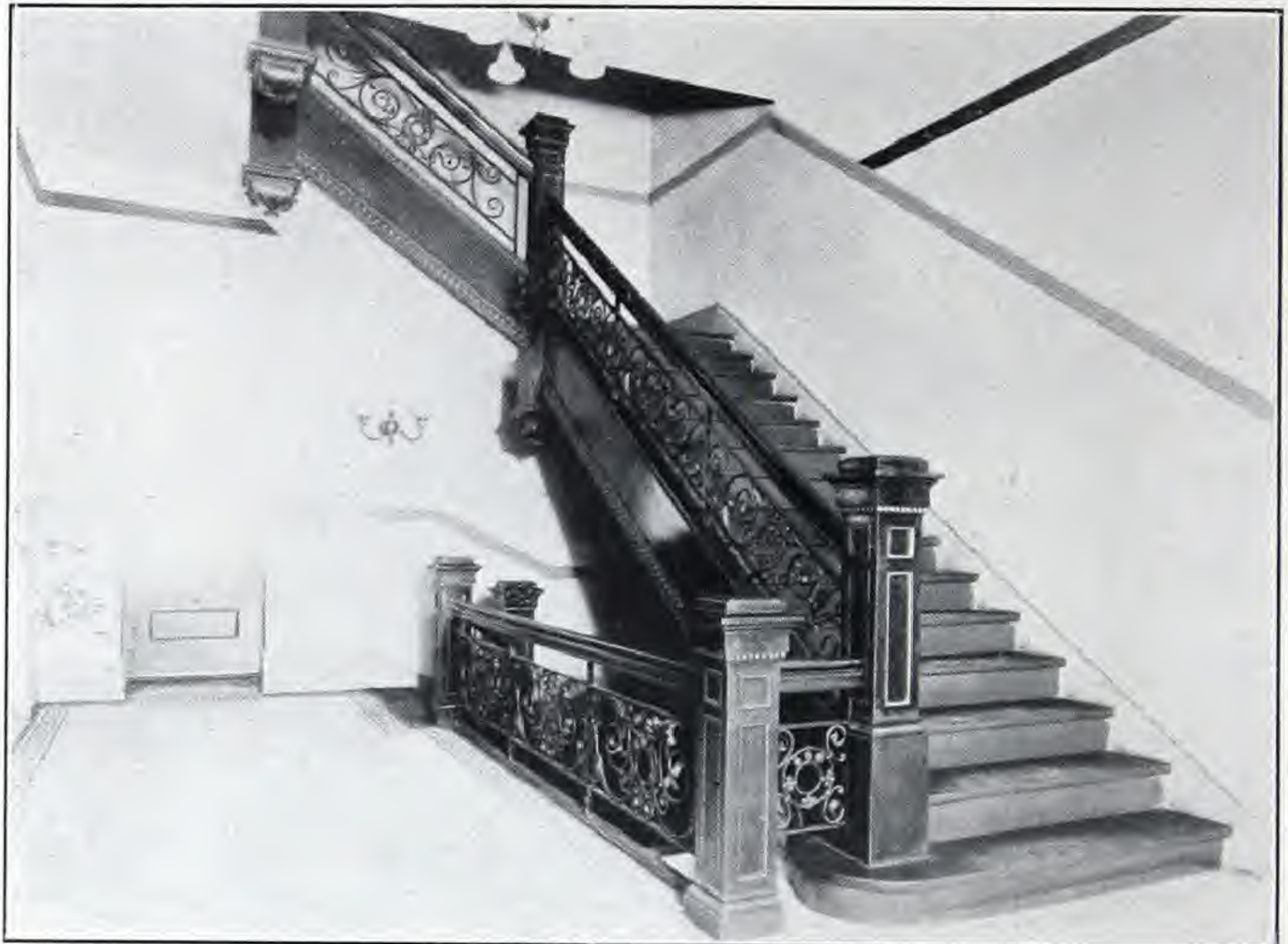
Office: 88 River Street.

Works: Rear 88 River Street

TORONTO, - ONT.

PHONES: { Main 5053, Office
 Adel. 2283, Works
 Beach 1026, After Hours

Products Designers and workers in Iron, Brass and Bronze, Bank Grilles, Artistic Hammered Work, Marquises, Ornamental Fencing and Gates, and Store Fronts.



Stairs Erected in Calgary City Hall

Modern Method Stairs

We specialize on "Modern Method" Stairs, as shown in the above illustration.

They are installed in many of the modern buildings in Toronto, Ottawa, Winnipeg, Calgary, Edmonton, and other Cities, and are specified by leading Architects.

The "Modern Method" Stairs are the neatest and strongest stairs made. They are manufactured by specially designed machinery, and made and erected in less time than any other style. The time saved in construction of important buildings is invaluable to Architects and owners.

Designs and Specifications

We cordially invite consultation on any problems in Ornamental Iron Work of any description.

The Dennis Wire & Iron Works Co. Limited

Head Office and Works:

LONDON, - - - - - ONT.

AGENCIES:

VANCOUVER
Wm. N. O'Neil & Co.

OTTAWA
Standard Supplies Ltd.

HALIFAX
Frank A. Gillis & Co.

CALGARY
Canadian Equipment & Supply Co.

REGINA
H. S. Abbott Supply Co.

Products Manufacturers of Ornamental Iron, Bronze and Wire Work of every description, including: Railings, Grilles and Metal Wickets for Banks, Offices, etc., Iron and Bronze Gates, Bronze Tablets, Complete Iron Stairs, Elevator Enclosures, Marquises, Balconies, Church Metal Work, Fire Escapes, Crestings, Wire Window Guards and Screens, Metal Store Fronts, Steel Window Sash, Jail Cells, Stable Fittings, and the Famous Demisteel Lockers and Shelving.

Quality of Our Products—

It has always been our policy to produce only goods of sterling quality. From the selection of material to the last finishing touch, each piece of work receives the painstaking attention which only skillful craftsmen know how to bestow. Our products can be found in every part of Canada, and if you desire, we will furnish you with lists of our customers.



Special Details and Designs

We will furnish full information as to sizes and weights of materials, with preliminary sketches, designs and full-sized details of ornamental iron work, if desired. Particular attention will be given to the careful execution of your drawings, endeavour to carry out the work in the spirit as well as to the letter of the design.

Facilities—Our large modern factory devoted exclusively to the production of Ornamental Iron, Bronze and Wire Work, and equipped with every facility for the manufacture of work of the best grade, and a well-organized staff of skilled designers and craftsmen, enables us to promptly execute any work entrusted to us, no matter how large or small the contract may be. Shipments are made in the shortest possible time after the receipt of the order, to any part of the country.

Our Services—We issue a "Catalogue of Architectural Details," containing many photographs of our work, with sketches and working drawings of our various designs and details.

While our "Catalogue of Architectural Details" shows many stock patterns, we are always ready to estimate on special designs in accordance with the drawings and specifications of the Architect.

We will gladly place our engineering and designing staff at your disposal until a satisfactory solution of your problems in connection with Ornamental Metal Work has been obtained.



Steel Lockers and Shelving.
The modern equipment for Shop or Office. Handsome appearance, permanent, fire-proof, sanitary, non-breakable. Built on Unit System. Circular "Efficiency" on request.

CANADA WIRE AND IRON GOODS COMPANY

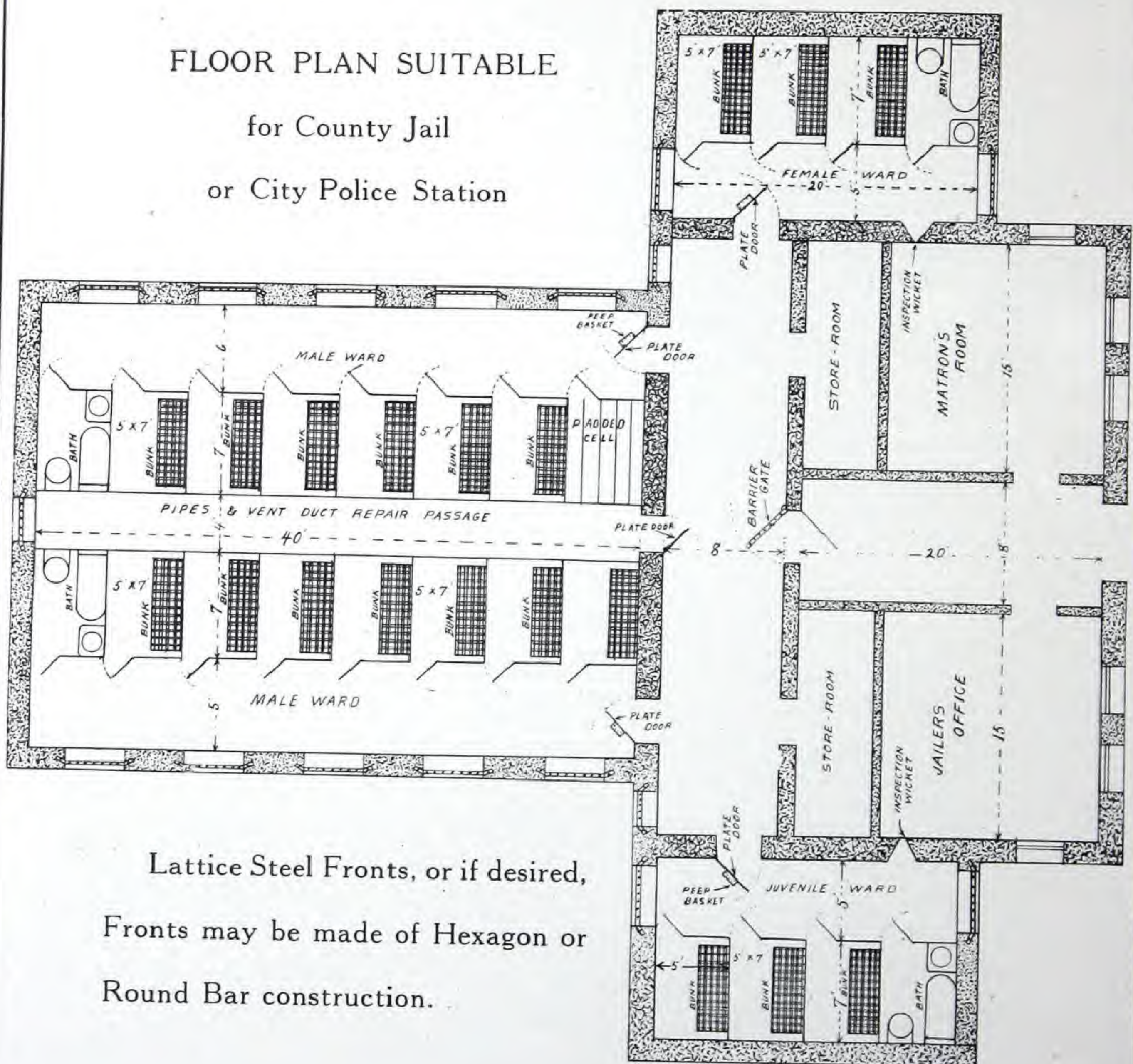
HAMILTON, - CANADA

Product Jail Cells, Window Gratings, Plate and Lattice Steel Bar Doors and Miscellaneous Jail Work.

Specialists In all kinds of Steel Cells, Steel Work, etc., for Prisons, Jails, and City Lock-ups.

FLOOR PLAN SUITABLE

for County Jail
or City Police Station



Lattice Steel Fronts, or if desired,
Fronts may be made of Hexagon or
Round Bar construction.

Continued on next page

CANADA WIRE AND IRON GOODS COMPANY

HAMILTON

=

CANADA

About Jail Cells The question of Jail Cells is a very important one to every community, as it involves so many different phases of the question. The present standard of civilization demands better conditions for our criminal classes, realizing that it is of vital importance to educate the unfortunate to better conditions, both from the standpoint of cleanliness and sanitation.

The old-fashioned dismal Cell and wooden pens with a plank bed must disappear entirely, being harborers of vermin and unfit for human beings' use, say nothing about the danger from fire. In many progressive Municipalities these conditions have been remedied.

For Town and Village use, the ideal Cell is a construction of steel throughout, such a Cell can be placed in a section of any Municipal Building.

Locking Devices We have equipment to meet all contingencies.

Service We construct our work according to Architects' plans and specifications or under our own supervision.

Ornamental Iron We also manufacture Artistic Iron work of all kinds and for all purposes.

About Our Line We manufacture the most complete line of Jail Cells and Prison Work in Canada.

Correspondence We will gladly co-operate with Architects and others in the working out of plans, specifications, details, etc.

DYER FENCE AND SUPPLY COMPANY, LIMITED

645 King Street East

TORONTO - - - ONTARIO

Produce Our business is **Fences**. We make and erect everything in **Fences and Gates**, from the simplest **Wire Fence** for farm and suburban use to the most elaborate and massive **Iron Work Effects**, plain, substantial **Iron Fences**, **Unclimable Wire Fences**. Entrance Gates, Enclosures of special design for Tennis Courts, Poultry, Cattle, Dog Kennels, etc. Iron and Wire Arbors, Trellises, Garden Appliances, Window Guards, and Concrete Reinforcing.

Fence at Mount Pleasant Cemetery, Toronto



Designed
by
Messrs. Burke
Horwood & White
Built by
Dyer Fence & Supply Co.

Crown "T" Iron Fence The New Fence. Simple, Strong, Durable and Attractive. Made with an inflexible joint which facilitates construction and adds to the strength. This method of construction enables us to supply a cheaper, stronger and more attractive fence for your money. Suitable for Suburban Homes, Country Clubs, City Lots, Churches, Schools, Parks, Etc.

Crown Superior Wire Guards Made on the most approved and up-to-date methods to insure durability and design at a minimum cost.

Equipment We are equipped to handle any contract, large or small, furnish the fence material or supply and erect the fence in place.

Erection Our erectors, or outside men, are all skilled workmen who know how to put up fences right under any and all conditions.

Estimates will be furnished upon request.

For anything in the Fence line consult the "Crown" Fence Catalogue

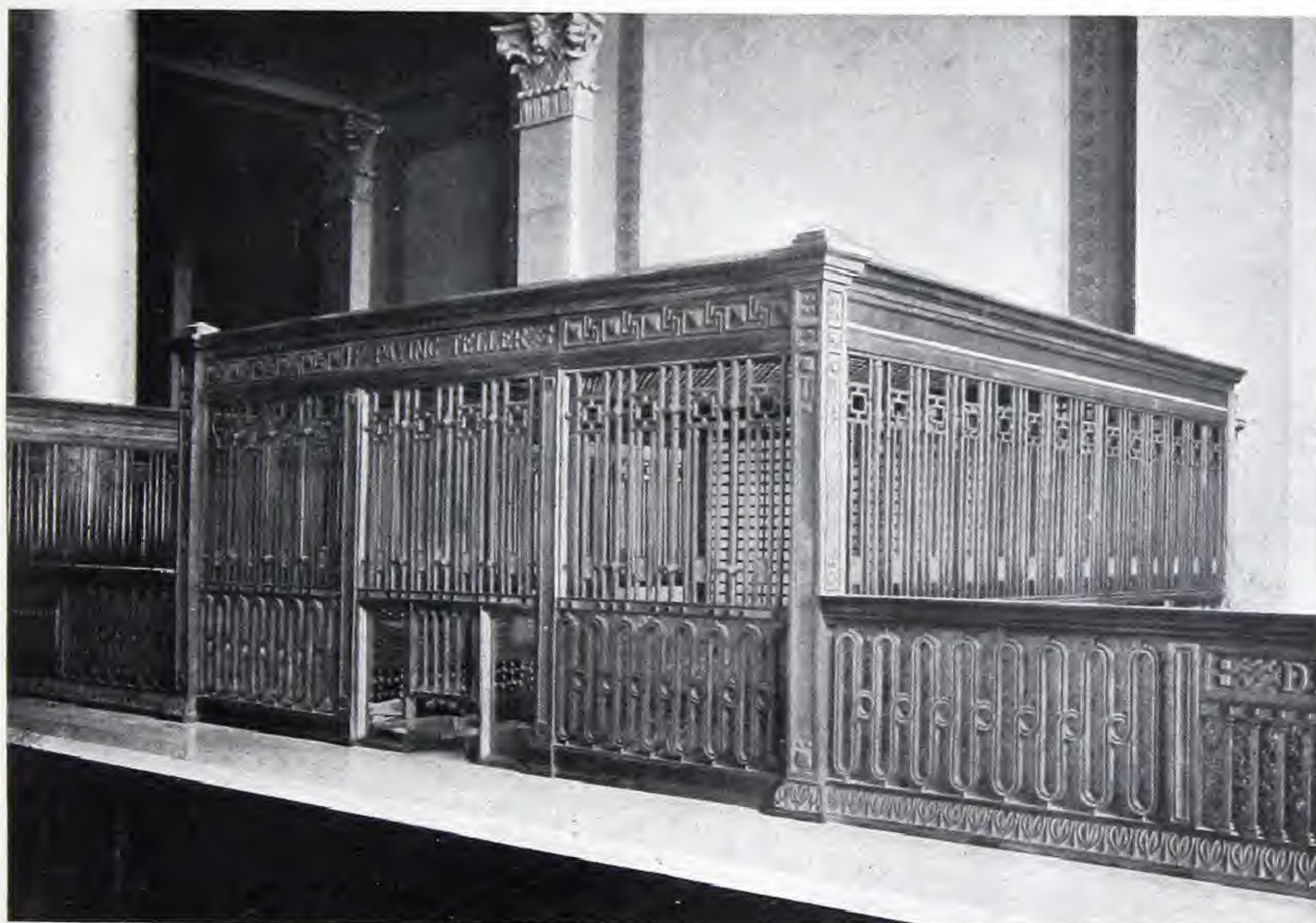
THE GEO. B. MEADOWS TORONTO WIRE, IRON AND BRASS CO. LIMITED

479 West Wellington Street

TORONTO, - - - ONT.

Product Fine Bronze Interior Fittings for Banks, Bronze and Brass, Signs, Tablets, Lamps, etc. Ornamental Wrought Iron Entrance Gates, Fences and Railings, Elevator Cabs and Enclosures, Iron and Marble Stairs, Fire Escapes and Builders' Iron Work.

Sheet Steel Shelving, Lockers, Library Book Racks, Wire Window Guards, Partitions, Machine Guards and wire work generally.



Quality We take great pride in the quality and splendid workmanship of our products. Our castings are clean and smooth with ornamental details sharp and clean.

Factory We have the most modern machinery to manufacture and finish Ornamental Iron Work, procurable.

Service We are prepared to give prompt and careful attention to all large or small contracts, in any part of the country.
Correspondence invited.

ESTEY BROS. COMPANY

ORNAMENTAL BRONZE AND IRON WORK

New York - Montreal

Branch Offices:

N. J. Dineen & Co., Ltd.
Winnipeg, Calgary and Vancouver

Scott, Hammond & Pratt,
Toronto, Ont.

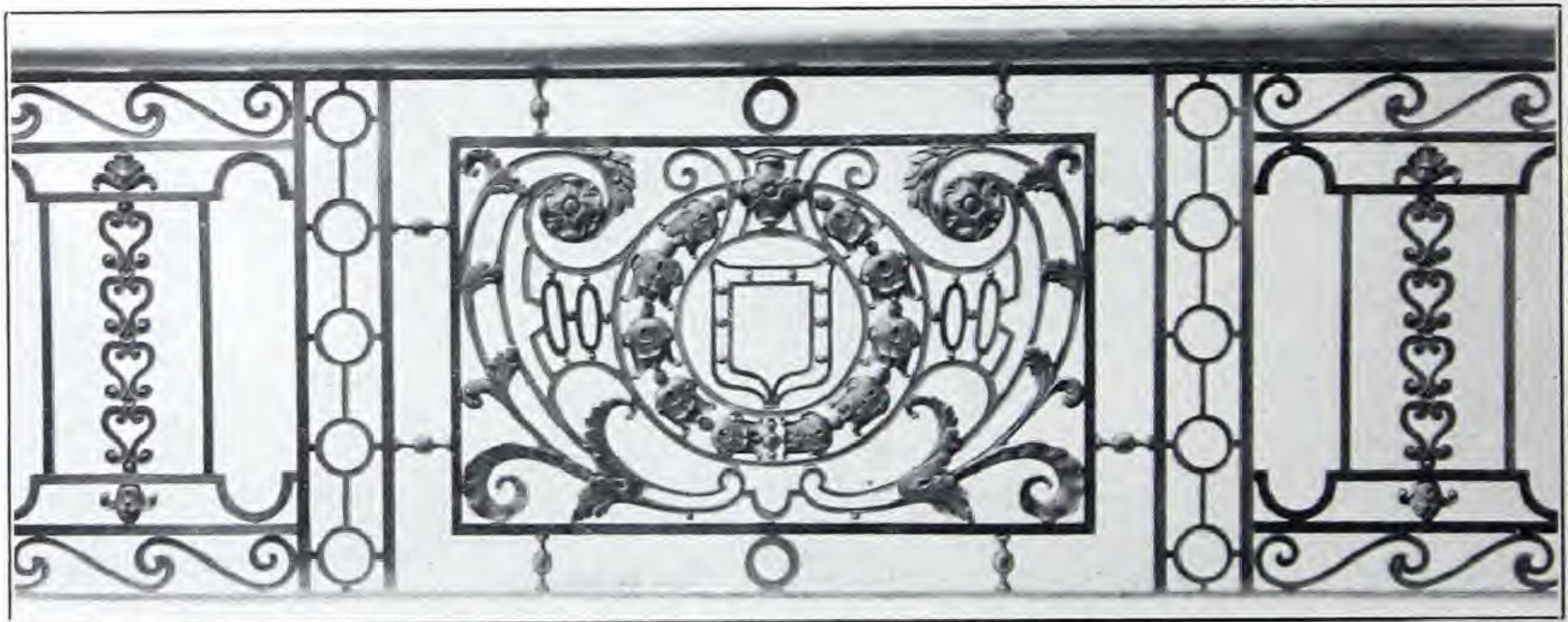
Canadian Works:

St. Cecile—St. James and
Cathedral Sts.

Office: 2-4 St. Cecile Street

Products Architectural and Ornamental Bronze, Brass, Iron and Electro-Plated Work in all its branches.

Specialists in High Class Bronze Work, Counter Screens, Entrance Doors, Lamp Standards, Tablets, Bank Cages, Elevator Enclosures and Cabs, Stairwork, Grilles, Fences, Railings, etc.



Fort Garry Hotel, Winnipeg

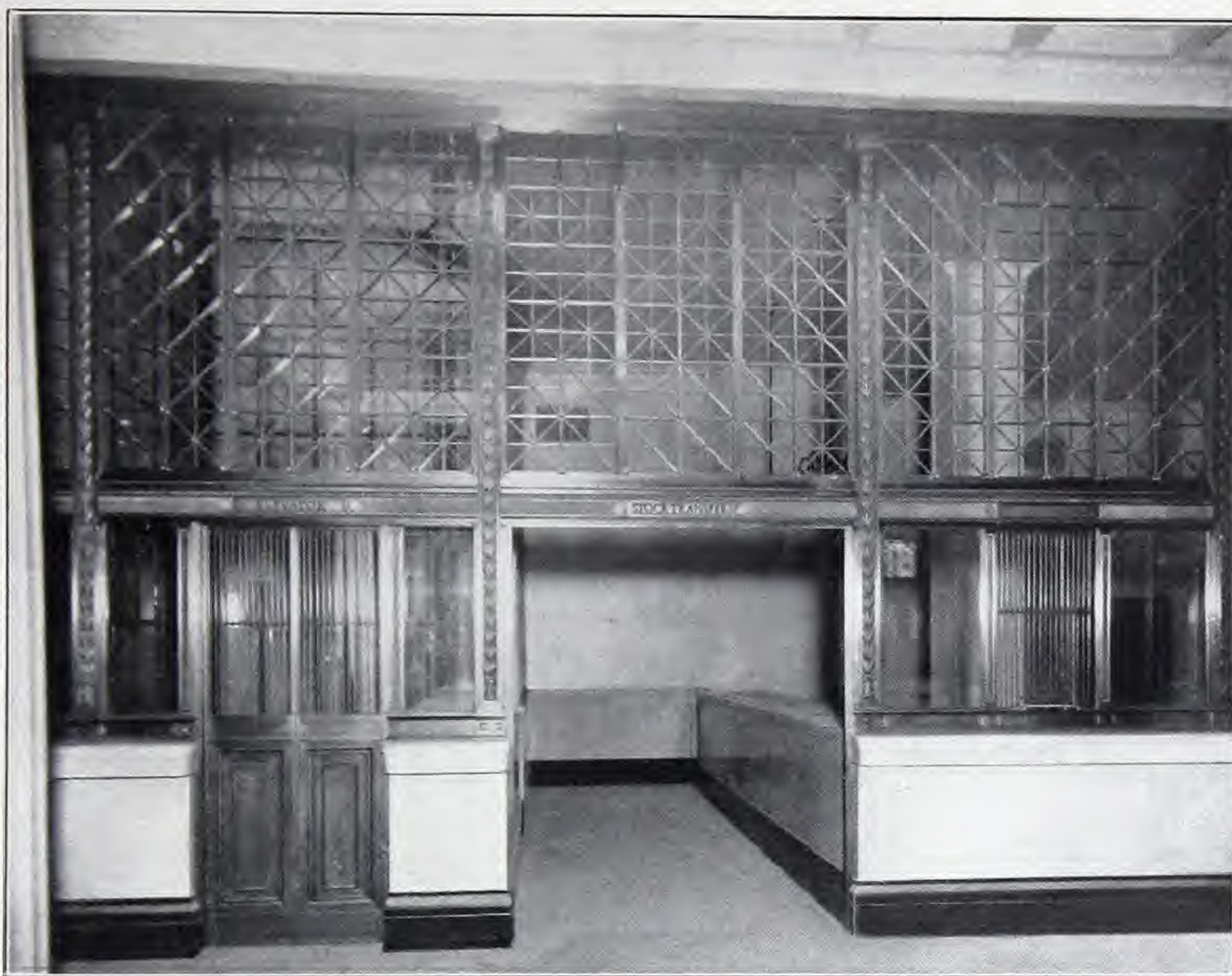
Bronze Railing

Ross & MacDonald, Architects

Facilities Our Canadian plant is thoroughly equipped with the most modern machinery and is in charge of an efficient staff trained in the best American factories. Our designing department is at the service of Architects and we request the opportunity of co-operating with them at any time in the preparation of details.

Continued on next page

ESTEY BROS. COMPANY



Royal Trust Building, Montreal

Bronze Counter Screen

McKim, Mead & White, Architects



Royal Trust Building, Montreal

Main Staircase

McKim, Mead & White, Architects

SAMUEL YELLIN

HAND WROUGHT METAL WORK

PHILADELPHIA, Pa.

Product—All styles of Gates, Grilles, Hardware, Lighting and Fire-place Fixtures, Etc., executed in the most artistic manner, in Medieval craftsmanship.



Wrought Iron Screen for the Cathedral of St. John the Divine, New York.
LaFarge & Morris, *Architects*.



Wrought Iron Hardware for the
First Baptist Church, Pittsburg, Penn.
Cram, Goodhue & Ferguson, *Architects*



Wrought Iron Lantern with Bracket for the
Union Central Life Insurance Building
Cincinnati, O.
Cass & Gilbert, *Architects*

ESTABLISHED 1853

G. BOOTH & SON

BRASS & BRONZE

SIGNS

ELECTRIC SIGNS
WIRE SCREEN SIGNS
CARVED GOLD LETTERS
PLATE GLASS SIGNS
ILLUMINATED SIGNS

PAINTING & PAPERHANGING

21 ADELAIDE STREET WEST
TORONTO, CANADA

Quality

Our products are uniformly of the highest grade both in the matter of workmanship and materials.

Experience

With a successful business record extending over sixty years, we are in a position to offer the high class service that only long and painstaking effort makes possible. Our plant is equipped with every modern device, which with a staff of expert designers and craftsmen qualifies us to fulfill in every detail any obligation or contract we may assume.

Specialize

We specialize on Brass, Bronze Signs, Carved Folo Letter Signs, in fact any character of sign, we supply and manufacture.

Phone:—Main 1567

J. E. RICHARDSON & CO.

147 Church Street

Phone Main 7363

TORONTO, - ONT.

Specialties

Window Letters of every description. Embossed Glass Signs, Engraved Brass Plates, Cast Bronze Signs, House Numbers. Number Tablets suitable for Church Pews, etc. Enamelled Iron Signs and Tablets. Carved Wood Letters, Raw or Gilded. Wood Signs, etc., etc.

Service

All our work is carried out to the Architects' details or our own design in an artistic and workmanlike manner.

Estimates and information furnished on request.



KAWNEER MANUFACTURING CO., LIMITED

TORONTO, CANADA

AGENTS :

Kawneer Mfg. Co., Ltd.,
1017 New Birks Bldg, Montreal, Que.
Canadian Western Builders Supplies, Ltd.,
301 Dominion Bank Bldg., Saskatoon, Sask.
Saskatchewan Glass and Supply Co., Ltd.,
Moose Jaw, Sask.
The J. H. Lavallee Co., Ltd.,
Edmonton, Alta.
D. J. Mackenzie,
194 Queen St., Ottawa, Ont.

Braid & McCurdy,
Tribune Bldg, Winnipeg, Man.
Western Supply and Equipment Co.,
Lethbridge, Alta.
Western Supply and Equipment Co.,
Calgary, Alta.
Ames Bros.
Welton Block, Vancouver, B.C.
R. Angus,
1105 Wharf St., Victoria, B.C.

Manufacturers of Kawneer Store Fronts in solid copper, brass, bronze and aluminum; Kawneer Architectural Metal Mouldings in cold-rolled and drawn copper, brass, bronze, aluminum and steel.

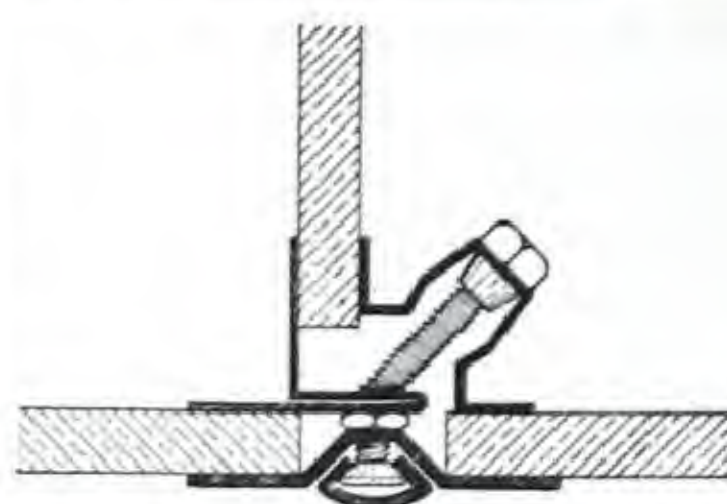
In addition, many architectural metal mouldings, as well as special mouldings made to the particular specification of the architect, can be furnished promptly. An engineering department is maintained to give you complete information, accompanied by drawings to architects wherever special usages of construction are required.

Kawneer No. 30 Metal Sash, shown in the accompanying details, provides for the regulation of show window ventilation and drainage. By moving the V-shaped slide every vent-hole in the gutter is simultaneously opened or closed. The slide is operated from the

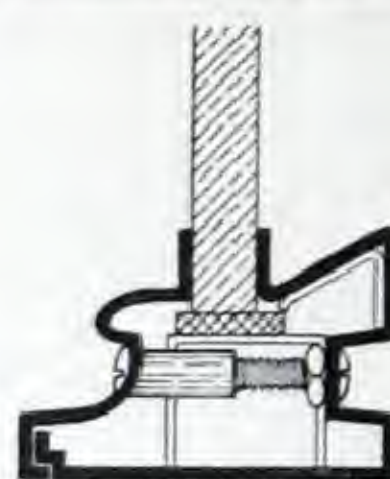
inside of the show window, and is made, as are all other parts, of solid copper, brass, bronze, or aluminum, as desired. Metal Sash Nos. 30, 60 and 130 are equipped with movable slide.

"Kawneer" is a narrow inconspicuous, all-metal construction, designed to give the greatest possible space for window display. The glass is held rigidly with a spring cushion grip, which insures the safest possible setting for the glass; one that provides for the expansion and contraction, vibration from wind, and any inequalities in the thickness. All glass is set from the outside.

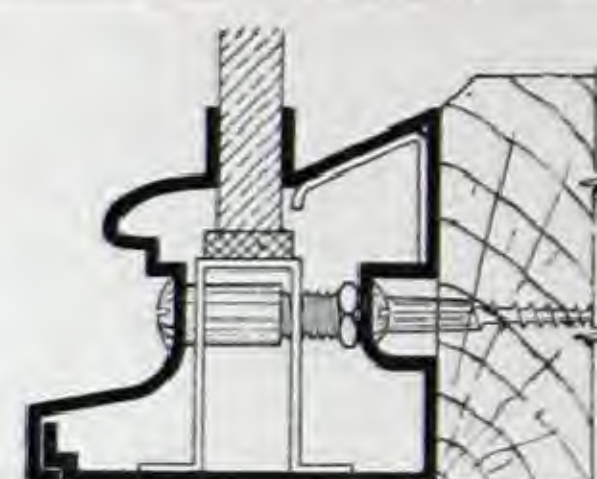
Metal Sash No. 30, No. 60, No. 100 and No. 130 are provided with a ventilation system that allows the entrance of a full current of air.



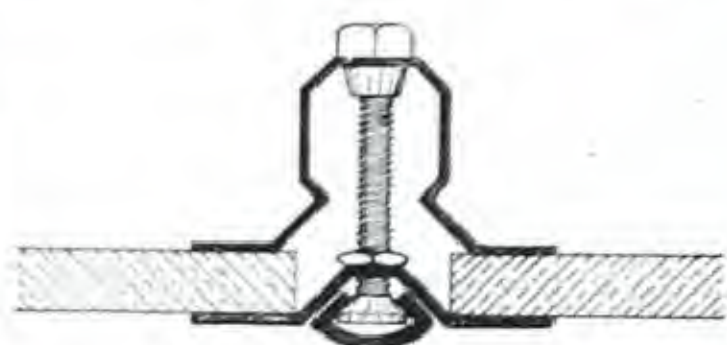
N° 8 THREE-WAY BAR



N° 60 SASH



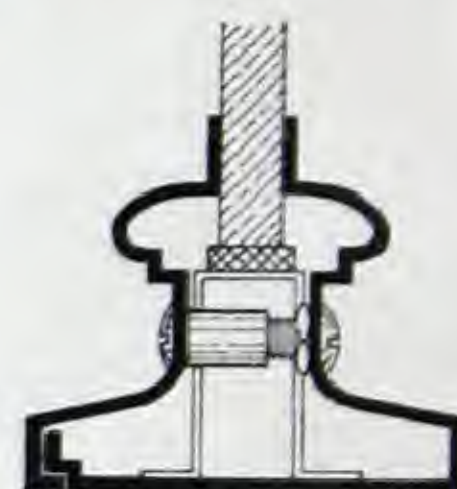
N° 130 SASH



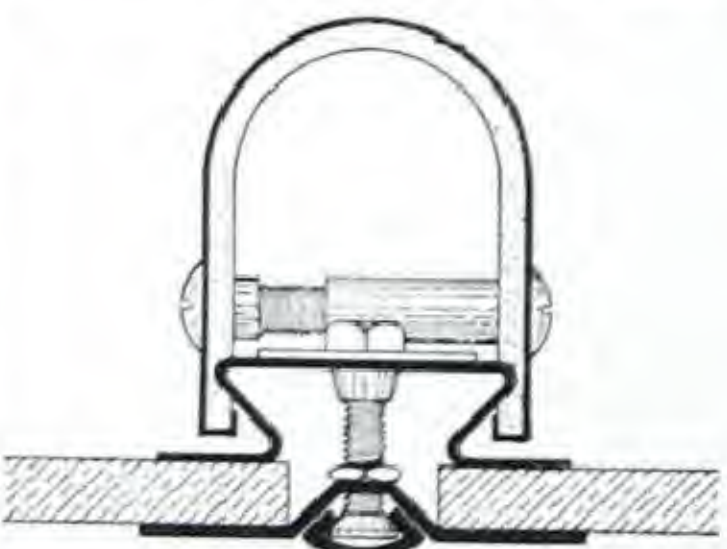
N° 14-A DIVISION BAR



N° 10 CORNER BAR



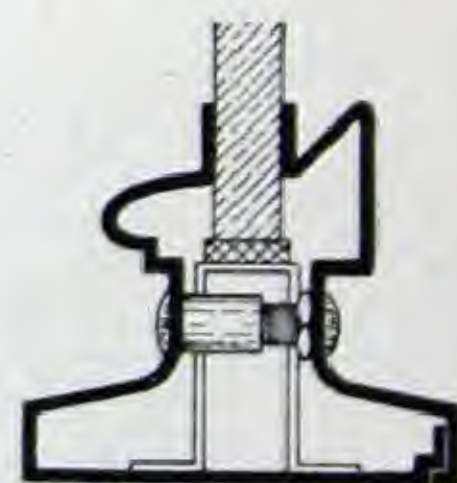
N° 150 SASH



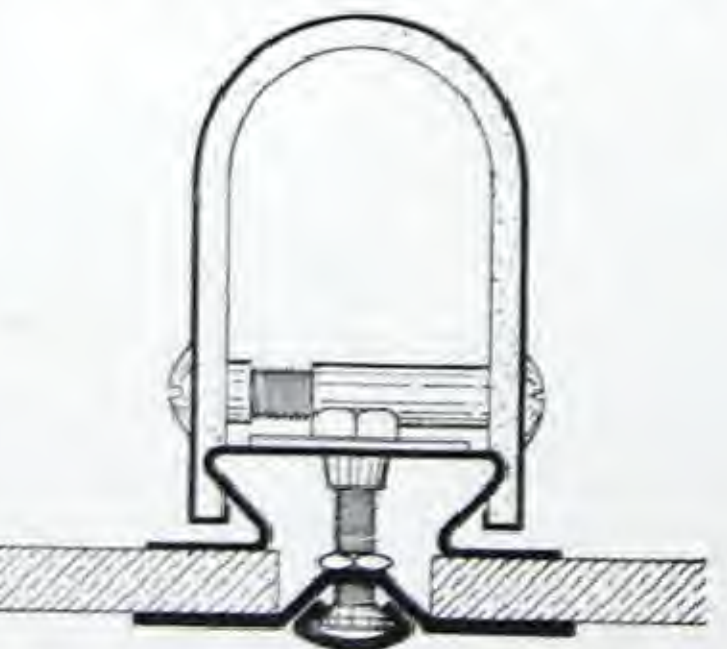
N° 21-B DIVISION BAR



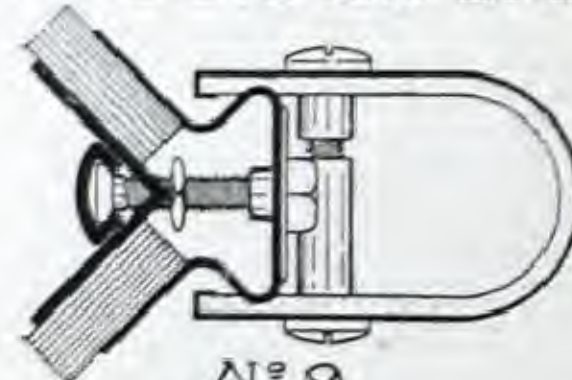
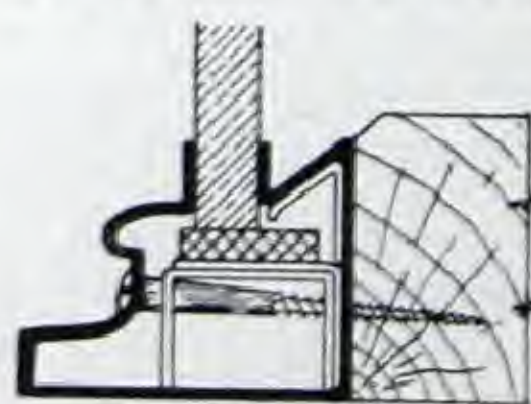
N° 5 CORNER BAR



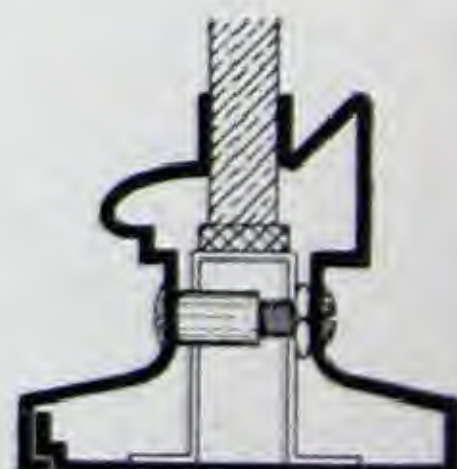
N° 50 SASH



N° 21-C DIVISION BAR

N° 9
REVERSE COR BAR

N° 30 SASH



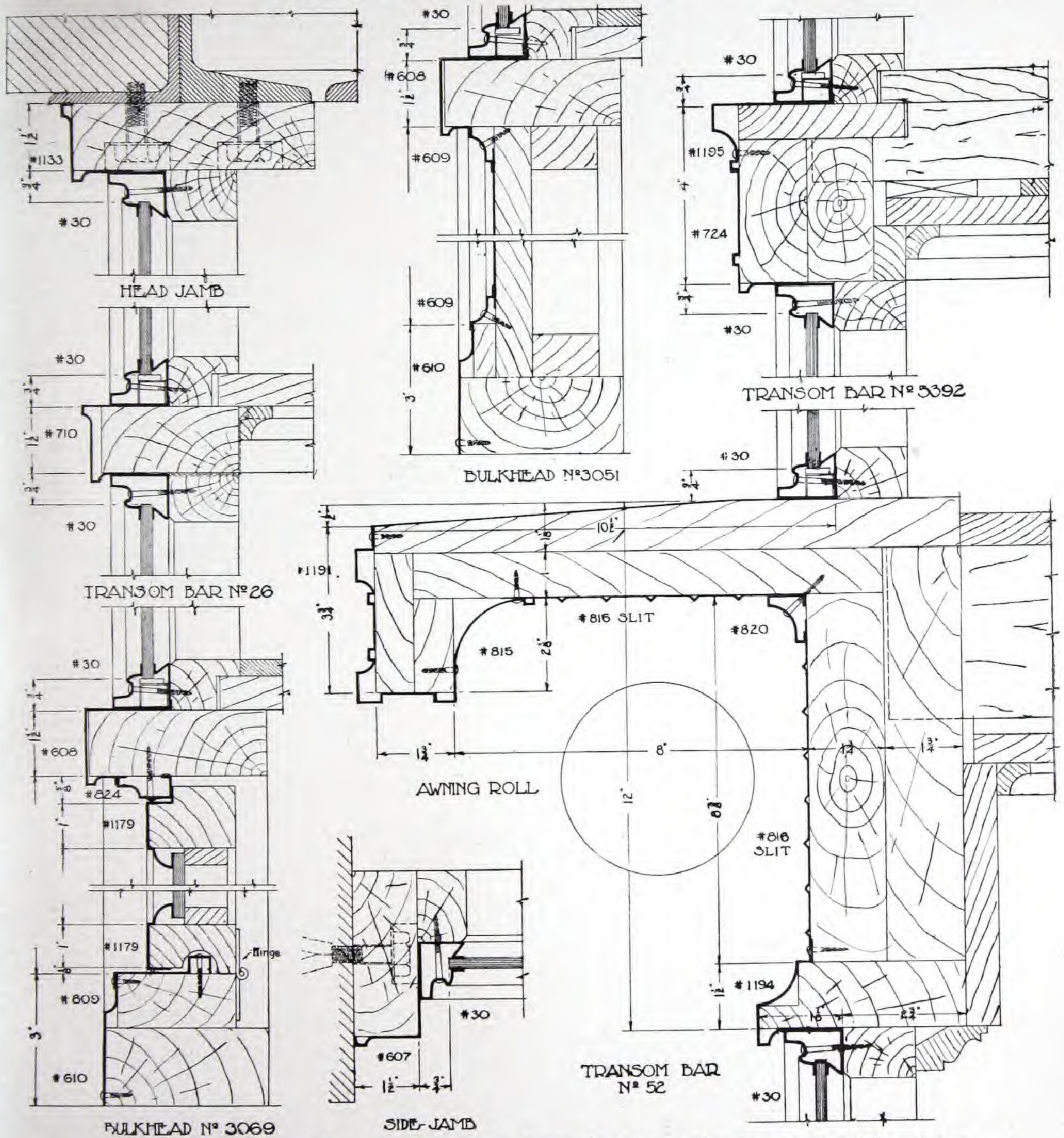
N° 100 SASH

This air circulates along the inner surface of the glass, absorbs the moisture and prevents the formation of frost or sweat. Drainage is also provided for, and in summer Sash Nos. 30, 60 and 130 can be made absolutely dust-tight by the slide built in the gutter.

All sash may be set directly against a brick, iron, concrete, marble or wood jamb or sill. A backing, either of wood or an angle iron $1\frac{1}{8}$ " high, is used in which to fasten the screw of Sash Nos. 30 and 130. All other sash are self-supporting and require no backing whatever.

Sash No. 50 is especially designed for displays above the first storey. Glass is set in this sash from the inside.

Details of Kawneer Store Fronts, Quarter Full Size



BULKHEAD N° 3069

SIDE-JAMB

All exposed metal is either copper, brass, bronze or aluminum, pure lake copper being used for all oxidized or antique copper finishes, as well as for the polished copper finish. This gives absolute freedom from rot, rust or warp, and obviates any necessity of painting the store front.

E A S Y S E T



S Y S T E M

WINNIPEG, MAN.

Head Office: TORONTO, ONT.

H. J. ST. CLAIR COMPANY, LIMITED

MANUFACTURERS AND JOBBERS

Specialists in Store Front Construction

Representatives:

Dartnell Ltd. Montreal, Que.
 Marier & Tremblay, Ltd. Quebec, Que.
 McFarlane & Douglas, Ltd. Ottawa, Ont.
 Winnipeg Paint and Glass Co. Winnipeg, Man.
 General Builders' Supply Co. Moose Jaw, Sask.
 Twin City Sand Co. Fort William, Ont.
 Twin City Sand Co. Port Arthur, Ont.
 Calgary Paint and Glass Co. Calgary, Alta.

Wm. N. O'Neil Co. Vancouver, B.C.
 Wm. N. O'Neil Co. Victoria, B.C.
 McKenzie-Hazell Supply Co. Regina, Sask.
 Edmonton Paint and Glass Co. Edmonton, Alta.
 Bowman Supply Co. Prince Albert, Sask.
 McKenzie & Thayer, Ltd. Saskatoon, Sask.
 J. B. Turney & Co. Lethbridge, Alta.
 Consolidated Plate Glass Co. Toronto, Ont.

No. 4A—Shows half-size detail of our Corner Bar. Note how the reinforcement fits inside the outer covering—thus, when the bar is installed and the nut is tightened, it draws the outside of the bar to the glass, instead of forcing it away, as is the case with most bars. The glass is gripped some distance from the edge, thus preventing breakage from “pinching”—a small piece of wood fitted over the screw protects the edge of the glass. This bar takes various thicknesses of plate glass without bending or springing the metal.

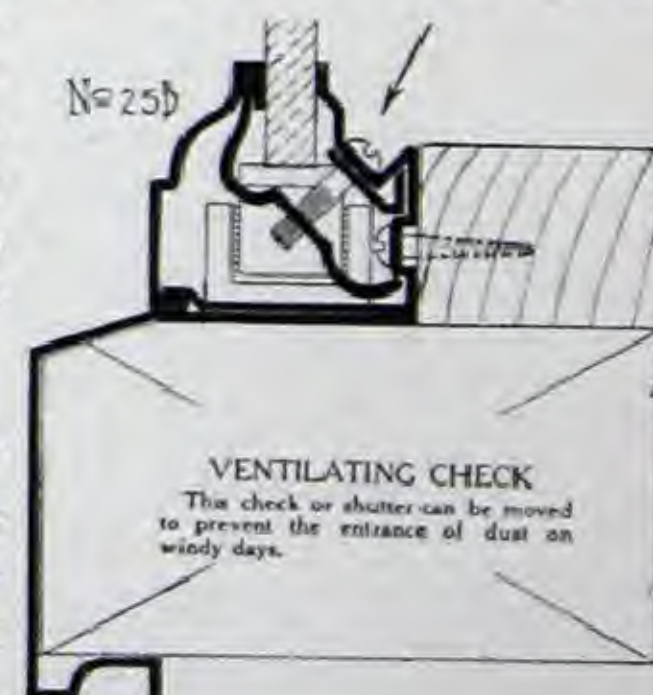
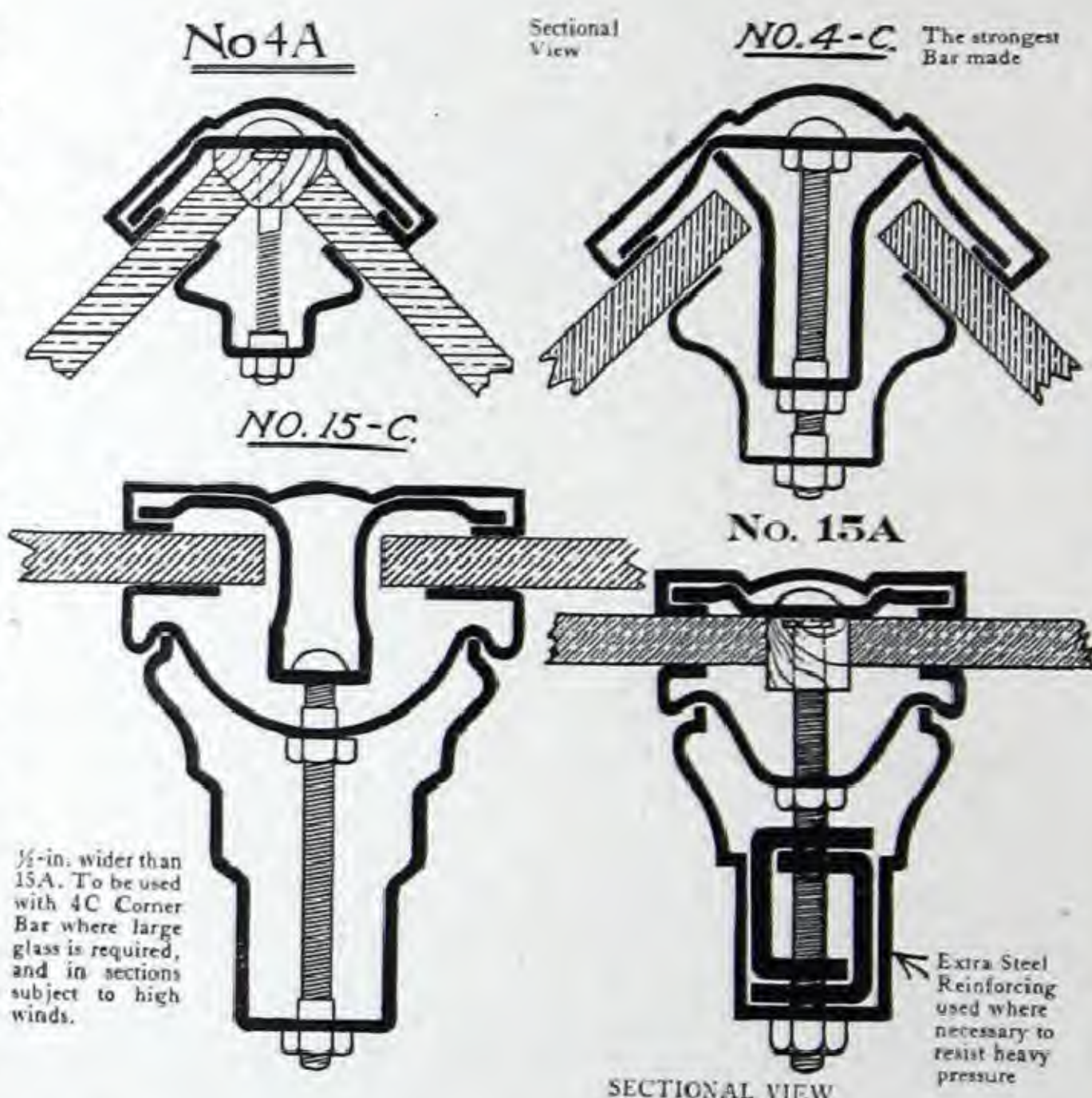
No. 4 C. similar to 4 A., but larger; also reinforced by steel. This bar we highly recommend.

No. 15 A.R., shows half-size detail of our Division Bar. As with the Corner Bar the reinforcement fits inside the outer covering and the same principle is employed—that of drawing the outside section of the bar to the glass. The edges of the glass are also left free, preventing “pinching.” This bar is also arranged to provide for variation in thickness of glass. The end of this bar rests on the edge of the metal sash rail, and the inner part is anchored to the floor. Small steel anchors, with screws complete, are furnished for this purpose. This shows the steel reinforcement, which is not necessary under 108” glass.

No. 25 B. Sash Rail is so constructed as to be readily applied to stone, marble, brick or steel. The setting block is of solid steel, mounted with leather. It is in two pieces and readily adjustable; it can be raised or lowered. This absolutely prevents the edge of the glass from coming in contact with metal. All caps which cover joints are then put in place. These caps, with the necessary screws, are shipped with each order. This rail is a frost-preventive when show windows are built air-tight, allowing only the air entering through the metal sash to circulate. It has the drainage system also.

Made of heavy gauge Copper, Brass, Aluminum, or Bronze.

Special finishes:—Oxidized, Nickle, Gun Metal, Statuary Bronze, Satin Bronze, Satin Brass. If interested, send for our catalogue, showing the great invisible awning and our different mouldings.



ELEVATORS AND LIFTS

TYPES.

Elevators are usually classified into four types, namely, electric, hydraulic, belt and hand power, and it is well to consider the advantages of each type when specifying the elevator equipment for any building.

(Electric Elevators.)

The electric elevator is a popular type, for the reason that it is adaptable to a number of conditions. The drum type belt driven electric machine being used for low speed freight and where the cost of installation is considered. The direct connected type is also used for freight service and for medium speed passenger elevators. The traction type of electric elevator is built in both geared and gearless type. The geared traction being used where high speed and a medium travel is required for passenger service in an office building, hotel or store. The gearless type is used for high speed and for high rise passenger service, being particularly adapted for office buildings, hotels or store equipment where high speed is required.

(Hydraulic Elevators.)

Hydraulic elevators are built in two distinct types, known as plunger and cylinder machines.

The plunger hydraulic machine is designed for both medium and high speed and for both freight and passenger service. Same can be operated by steam or electrically-driven pumps. This type is also used in a great extent for sidewalk or ash hoist, where the elevator may be operated by city water power.

The cylinder type of hydraulic machine, both vertical and horizontal, are used for passenger and freight service and for medium speed and travel. Both these types may be operated by steam or electrically-driven pumps.

(Hand-Power Elevators and Dumb Waiters.)

Hand-power elevators have their own place, and while ordinarily, where power is available, a power elevator is advisable, there are many conditions and requirements which can best be served by hand-power elevators and dumb waiters.

Where the loads are light, or the elevator is to be used only occasionally, where the loads are all down, for invalid elevators in private residences, the best type of hand operated elevators give good satisfaction and save considerable in first cost as well as in upkeep: For dumb waiters, as a rule, a good hand-power dumb waiter will prove more satisfactory than a power dumb waiter.

The whole secret of satisfactory results from the installation of hand-power elevators and dumb waiters, is in the selection of an outfit which is adapted to the conditions and requirements, and unless the customer is sure of just what he wants, he had better consult a reliable manufacturer who makes a specialty of hand-power elevators and dumb waiters.

LOCATION.

Elevators may be located in any part of a building if the work carried on demands. Usually, however, it is found to be most economical to install them in the stair well or a corner of the building, where they can be easily enclosed on all sides with solid brick walls, thus improving the building as a fire risk, and at the same time furnishing substantial support for the overhead construction.

SUPPORTS.

The overhead construction should be steel, and made very rigid. Ordinary considerations of strength to carry the assumed loads do not lead to good design in the case of overhead beams, as these are called upon to resist the stresses due to sudden stopping of the car when heavily loaded. It may be assumed that overhead beams in which the calculated unit stress is higher than 8,000 pounds per square inch, in steel, is not to be regarded as sufficiently rigid. In checking the strength of these beams use the net section, deducting all bolt holes, etc.

The overhead construction should rest on supports which are continuous to the foundation. These, in open construction, may be of suitable timber. When carried on brick walls (9) inches should be the least thickness used and suitable bearing plates or templets provided in order to properly distribute the load on the masonry. If the overhead beams are placed across the corner of a building, on the walls, all openings in the wall under the beams should be spanned by suitable steel beams or lintels.

When steel guides are used for the cars independent footings should be provided. The guides are made in lengths of about 20 feet and weigh approximately 300 pounds per length. They have the advantage of being more or less independent of the building, and therefore tend to remain in line, even if the building settles somewhat.

CABLES.

Cables are always installed which have a lifting capacity considerably in excess of the work they will be called upon to perform. A factor of safety of eight for freight hoists and ten for passenger service is conservative. Cables should never be smaller than $\frac{5}{8}$ inch in diameter and should always run over ample sheaves. One cable end should be fastened with a babbit socket on the end of a draw-bolt. The draw-bolt not to be of less diameter than the cable. Cable ends should be fastened inside the drum, being bent around the drum shaft and fastened with two clips.

SPEEDS.

In buildings of from four to five storeys the elevator speeds should be limited to 250 or 300 feet per minute. In higher buildings elevators may run as high as 400 feet per

minute for cars stopping at all floors. For so-called "express" cars in high buildings, where no stop is made for the first eight or ten floors, speeds as high as 500 feet per minute are in use, but this figure should never be exceeded. High speed cars, especially where the ceilings are low, are hard to bring flush with the floors, and their economy of time is doubtful.

Freight hoists should not travel more than from 50 to 75 feet per minute unless the elevator shaft is completely enclosed and the hoist in charge of an operator at all times. Where employees are allowed to use a hoist that is not well protected and is run at high speed it is a very dangerous machine.

Automatic passenger elevators usually are run at speeds from 75 to 100 feet per minute.

CAPACITIES.

Passenger cars are seldom made larger than 6 feet by 6 feet inside the car. There is nothing to be gained by large cars, experience having shown that a number of small cars give better service than one large one. In buildings without freight hoists it is usual to hinge the car front and the grill, of at least one car, and make the lifting capacity of the car sufficient to raise an ordinary safe, as well as office furniture. About 3,000 pounds is a common capacity. Passenger cars may have a load of 65 pounds per square foot of car floor area assumed as their usual load when full, and this allowance is ample. Freight hoists should never be installed, for general use, with a capacity less than 2,000 pounds, as they are very liable to overloading, especially so when large platform is used.

CONTROL, SAFETY DEVICES, ETC.

Hydraulic elevators should be equipped with pilot valve, to be worked with a hand lever in the car, and rotary cut-off or horizontal cut-off valve for limit stops.

Electric elevators of the magnet controlled type, made by all up-to-date firms, should be equipped with automatic circuit breaker at top and bottom of run (as well as a safety switch in the car). This is provided to meet the possibility of the car overrunning the machine limits, which act on the main line circuit-breaker and do the same work as the safety-switch in the car. This over-running is caused by the car "racing," which is one of the bad features of electric elevators not yet wholly overcome. Passenger elevators should be equipped with speed governors to act on the safety clutches on the car. This gives protection against falling or racing above speed. There are two types of safety clutches, slow acting, for use on high-speed elevators or cars running over 150 feet per minute, and quick-acting or instantaneous safeties, for slow-speed elevators. The same speed governors to be used on slow and fast running elevators and set as required.

Hydraulic plunger elevators do not need safety clutches or speed governors. The weight of the car is at all times carried on a column of water and it can not move in

either direction without a corresponding movement of the water in the cylinder, this in turn can only pass the valves at limited speeds.

Automatic elevators should be equipped with all the safety devices of the regular passenger elevator and in addition should have a gate on the car—the folding gate being the most usual.

All elevators should have a grill or heavy planking built under the overhead work, to prevent tools, parts or other material from dropping on the car.

Freight hoists should have the openings at each floor protected with automatic or semi-automatic gates or hatch doors which lift with the car and close after the hoist has passed. The height of these gates to be not less than (5 feet 6 inches), with not more than eighteen inches space between the bottom bar of the gate and the floor.

TESTS, ETC.

Hoists should be tested to capacity in the presence of the architect. Speed tests should also be made and the safety devices thrown in.

There are various forms of guarantees given with elevator installations; usually the elevator is guaranteed to be, and remain, in first-class working order for one year from date of completion. In case of breakage due to defective workmanship or material the contractor undertakes to make all necessary repairs or supply new parts free of cost to the owner.

SPECIFICATION CLAUSES.

GENERAL.

This specification with the accompanying drawings is intended to cover the installation of (electric) elevators of the type in located at , and is further intended to cover the supply and installation of all necessary foundation, guides, overhead beams, sheaves, hoisting machinery, cables, cars, controllers, grills, scaffolds, tools and everything necessary to a complete and satisfactory elevator equipment whether same is definitely mentioned or not.

WORKING DRAWINGS.

Immediately upon acceptance of the contract the contractor is to prepare working or shop drawings showing the proposed location of the necessary machinery together with sizes and strength of overhead beams, cables, etc., and submit same to the architect for his approval, but it is understood that such acceptance by the architect does not relieve the contractor of any responsibility.

CONDUCT OF WORK.

The contractor for the elevator equipment shall work in harmony with all other trades that affect his work. He shall keep informed of the progress of the construction and hold himself ready to start his work when the building is ready for his operations.

The contractor must furnish with his working drawings a specification for the work and elevator he proposes to do and supply, and shall definitely indicate the parts of the work that are to be done by other trades, and shall make it his business to give due notice to these trades when he is ready for their work.

GUARANTEE.

The contractor shall furnish a written guarantee upon the completion of his work to the effect that the materials used by him are of the kind and quality specified or understood, and that same have been installed in a workmanlike manner. He shall guarantee the elevator to be and remain in first-class working condition for a period of one year from date of completion, and shall make all repairs during that time that may be necessary or replace such parts as can not be satisfactorily repaired.

CONSTRUCTION DETAILS.

(Passenger Elevators.)

The contractor shall furnish and install complete elevators of the type. Each with a lifting capacity of pounds in addition to the weight of the car, and shall carry the full load at a maximum speed of feet per minute.

The cars are to be feet by feet inside dimensions, installed in an elevator shaft of feet by feet inside dimensions, finished.

Cars shall be arranged to travel from flush with the basement floor to the floor, a total distance, from floor to floor, of feet.

POWER.

(General.)

Power supplied, and to suit which the contractor will furnish his machine, is (1st) direct current at volts, to be brought within feet of the elevator machinery by the owner; (2nd) alternating current at volts, cycles, phase, wired by owner as for D. C. (3rd) Water from city mains at an average pressure of pounds per square inch at the main.

(Electric.)

The contractor is to furnish and install electric hoisting machine of the drum type, belt driven (direct connected) (traction type) geared [gearless] of his own design and built according to his own specifications. Same to have ample strength and provision for oiling and to be guaranteed to operate satisfactorily for years.

The motor supplied shall be of ample size and suitable to the requirements of the service. It must operate under full load for one hour without dangerous heating. The housing must be such as will furnish ample protection from injury to the windings.

All wiring done by this contractor shall be in accordance with the requirements of the Canadian Board of Underwriters (and should be such as to give maximum protection against a hot polished surface. There is no

(Hydraulic.)

The contractor is to furnish steam (electric driven) pumps capable of delivering sufficient water to enable elevators to make one trip, up and down, every minutes, with constant pressure of pounds per square inch at the pump on the suction side. Pumps are to be set on foundations provided by and all water connections between pumps and tanks and between tanks and elevator cylinders, also all steam and drip connections to be made by contractor in a workmanlike manner. Pumps to be equipped with all necessary valves, lubricating and governing devices.

The contractor is to provide and erect on foundations provided by steel pressure tank of total capacity of gallons. All seams caulked tight and remain so under hydrostatic pressure pounds per square inch in excess of the working pressure.

Also provide and erect on foundation provided by steel discharge having a total capacity of gallons.

FOUNDATIONS.

All necessary foundations are to be provided by and constructed according to drawings prepared and furnished by the contractor, and are to be of such material and workmanship as he shall indicate.

SUPPORTS.

Supports will be provided by the owner and will be of the construction and dimensions indicated on the accompanying drawings.

OVERHEAD BEAMS.

Overhead beams of steel (I sections) or wood (single sticks) shall be provided and placed by the elevator contractor. These shall be of such size and rigidity as to prevent all spring when a fully loaded descending car is brought suddenly to rest from full speed. Where overhead beams rest upon brick walls, suitable templates must be provided under the bearing parts of the beam to properly distribute the load to the brickwork.

GUIDES.

Car guides are to be of steel, in suitable section, and machined to a true surface. To be erected in line and securely fastened to supports and at all joints. Similar guides of suitable size are to be provided for counter weights.

Wooden guides are to be provided for car and counter weights, same to be of suitable hardwood thoroughly seasoned and fastened rigidly in place to prevent warping.

CARS.

Cars shall be so constructed with substantial steel (wooden) frame that all straining of the car will be avoided. Passenger cars to be provided with wrought iron enclosure as approved by the architect. The front, in addition to collapsible steel gate, to be hinged to permit of getting furniture, etc., into cars.

COUNTER WEIGHTS.

Cars are to be counterbalanced as provided for in the standard practice of the manufacturer to insure smooth and easy running of the cars.

CABLES.

The elevators are to be equipped with of the best wire cables not less than of an inch in diameter each, having an ultimate strength of pounds, and each capable of sustaining a working load of pounds with safety. The counterweights to be provided with of the best wire cables of an inch in diameter, of the same comparative strength as the main cables. Cables to be fastened with babbitt sockets and draw bolts in order to take up slackness. Cables to be fastened inside the drum by being twined around the drum shaft and held by two clips.

SHEAVES.

All sheaves shall be of cast iron of ample size for the cables used. They must be so proportioned as to avoid shrinkage strains in cooling, and must be sound castings of tough grey cast iron, carefully machined and grooved to fit the cables. They shall be keyed on to proper sizes of steel shafts, and shafts to run in long, babbitted journals, fitted with self-oiling device.

SAFETY DEVICES.

The elevators are to be equipped with such safety appliances as may be required by local by-laws, or with a safety grip under the car platform which will securely lock the car to the guides, should the cables break, and prevent its falling. Also with an automatic break on the machine designed to hold the cars at the landings when brought to a stop. Provide automatic slack cable stops on the machine to stop same and prevent the unwinding of the cable in case of the car or counterweights becoming obstructed. Also provide safety fuses to prevent the motors being damaged by overloading. Cars to be equipped with speed governors of approved design, same to operate on safety grip should car exceed speed limits.

Provide limit stops at top and bottom of elevator shaft to prevent car overrunning its limits of travel, and emergency or safety switch in car.

CONTROL.

Cars are to be fitted with controllers or operating devices of the contractor's design and such as will meet the approval of the architect.

CYLINDER.

The water cylinder to be of the vertical type (horizontal type), made of cast iron of sufficient thickness and strength to withstand

a test pressure of pounds to the square inch, the sections to be thoroughly and substantially bolted together, bored true and smooth, properly secured in place, and set upon suitable foundation.

PISTON AND PISTON RODS.

The piston to be made of cast iron, turned to fit the cylinder and attached to traveling sheaves by two solid piston rods. These rods will work through stuffing boxes placed in the head of the cylinder, and will be attached both to crosshead of traveling sheave frame and piston by means of nuts with lock nuts or pins to prevent unscrewing.

TRAVELING SHEAVES.

The traveling sheaves to be carefully constructed of the best grade cast iron and to be carried by means of heavy shafts in boxes attached to crosshead traveling in suitable guides.

PLUNGERS.

Plungers shall be made of heavy steel pipe turned true and smooth. Joints to be made by means of threaded nipples, to be smooth and tight. Plungers to be securely fastened to bottom of car and also to have steel cable tie from bottom of plunger to car. Plungers must have sufficient strength to lift the car fully loaded without perceptible deflection. Long plungers to have movable lateral stays, to lift with the plunger after car passes the floor.

PLUNGER CYLINDER.

The plunger cylinder to be made of steel pipe of ample strength, with threaded (flanged) joints made perfectly tight. The outside to be painted with approved waterproof metal paint, three coats. Joints to be well painted before cylinder is sunk. The contractor is to sink the cylinder well and be responsible for same and cylinder being plumb.

Cylinder to be fitted with stuffing box and lubricating device, and pan for drip.

LIGHTING.

Cars shall be provided with an electric light ceiling bracket having one lamp and suitable glass shade to harmonize with car trim. The contractor to supply and install all necessary wiring and flexible cable, conduit, etc., to make lighting system complete, and in accordance with the requirements of the Canadian Fire Underwriters.

ANNUNCIATORS.

The contractor shall supply and install an annunciator system to be selected by the architect and according to the contractor's specifications furnished with same.

OTIS-FENSOM ELEVATOR COMPANY LIMITED

MANUFACTURERS OF

PASSENGER AND FREIGHT ELEVATORS

Head Office:
TORONTO, ONTARIO

Works:
HAMILTON, ONTARIO

**Standard-
izing
Elevator
Construc-
tion**

We are prepared to supply standard layouts of elevators to all Architects and Engineers, who have the preparing of plans for buildings which give exact and reliable data to enable them to make proper provision for the reception of the elevator equipment, thus insuring from the start a proper installation without having to make expensive alterations when the building is about completed in order to obtain same. These drawings are carefully prepared along the lines of established practice, and it is only necessary therefore to select the type of elevator required, and provide in the plans the required clearances at the top and bottom in the hatchway and the space required for the machinery.

**Advant-
ages**

We have taken considerable pains to standardize elevator construction, as from past experience we have repeatedly felt this would be a great benefit to the Architect, in that the cost of installation could be materially reduced and deliveries facilitated if standard sizes were adopted; at the outset it would enable the Architect in preparing his plans to provide the necessary accommodation instead of the troublesome necessity of altering plans later on. We, as the manufacturers, could then make the parts in large quantities instead of a few at a time as it is now rendered necessary owing to the innumerable varying conditions. This would enable us to ship promptly from stock when required.

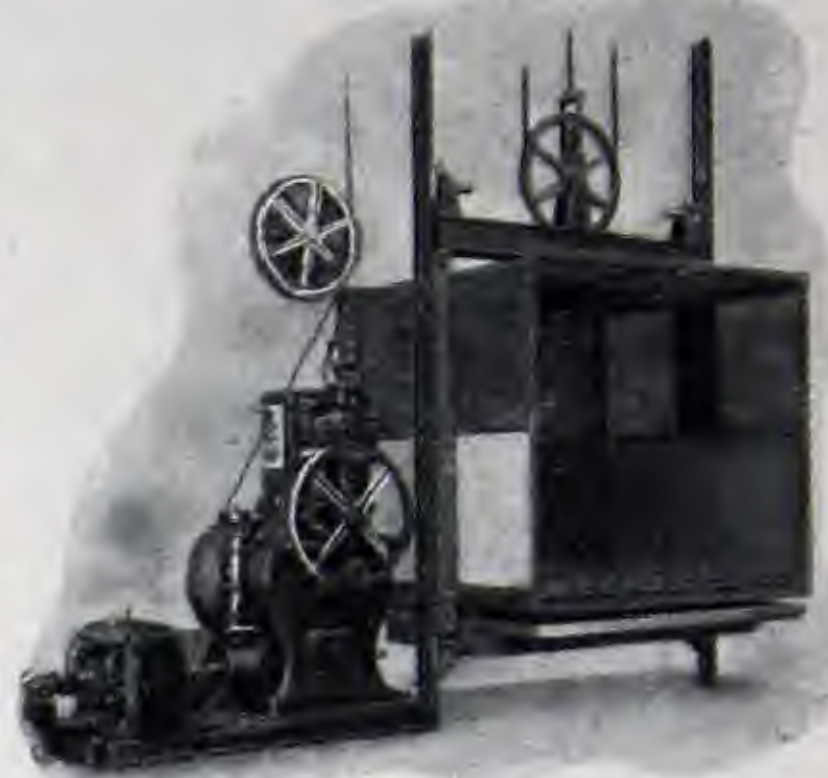
**Co-
Operation**

We are convinced that those interested will see the great advantage to all concerned by the use of standard layouts and standard sizes. We, therefore, suggest to those who have the preparing of plans for buildings in which elevators are required, that they do their part to co-operate with us in attaining this very desirable end.



STIGLER ELEVATORS

Electric, Hydraulic
and Beltdriven
Passenger and Freight
Automatic Push Button, Etc.



RADIO ELECTRIC COMPANY OF CANADA, LIMITED

Head Office :
805-7 New Birks Building

MONTREAL, QUE.

Works
51 Craig Street West

All Stigler elevators stop exactly at floor landings independent of load variation, even with push button control.

Special Features Perfect operation and control with alternating current
Three safety devices. Slack rope, Over speed, Obstacles.
Stigler safety devices are rugged in design and operate always as they do not depend on the action of springs.

Limit Switches: Separate Electrical, Mechanical

Brake Our V type brake stops machine instantly, therefore more effective than ordinary band type, liable to slip.

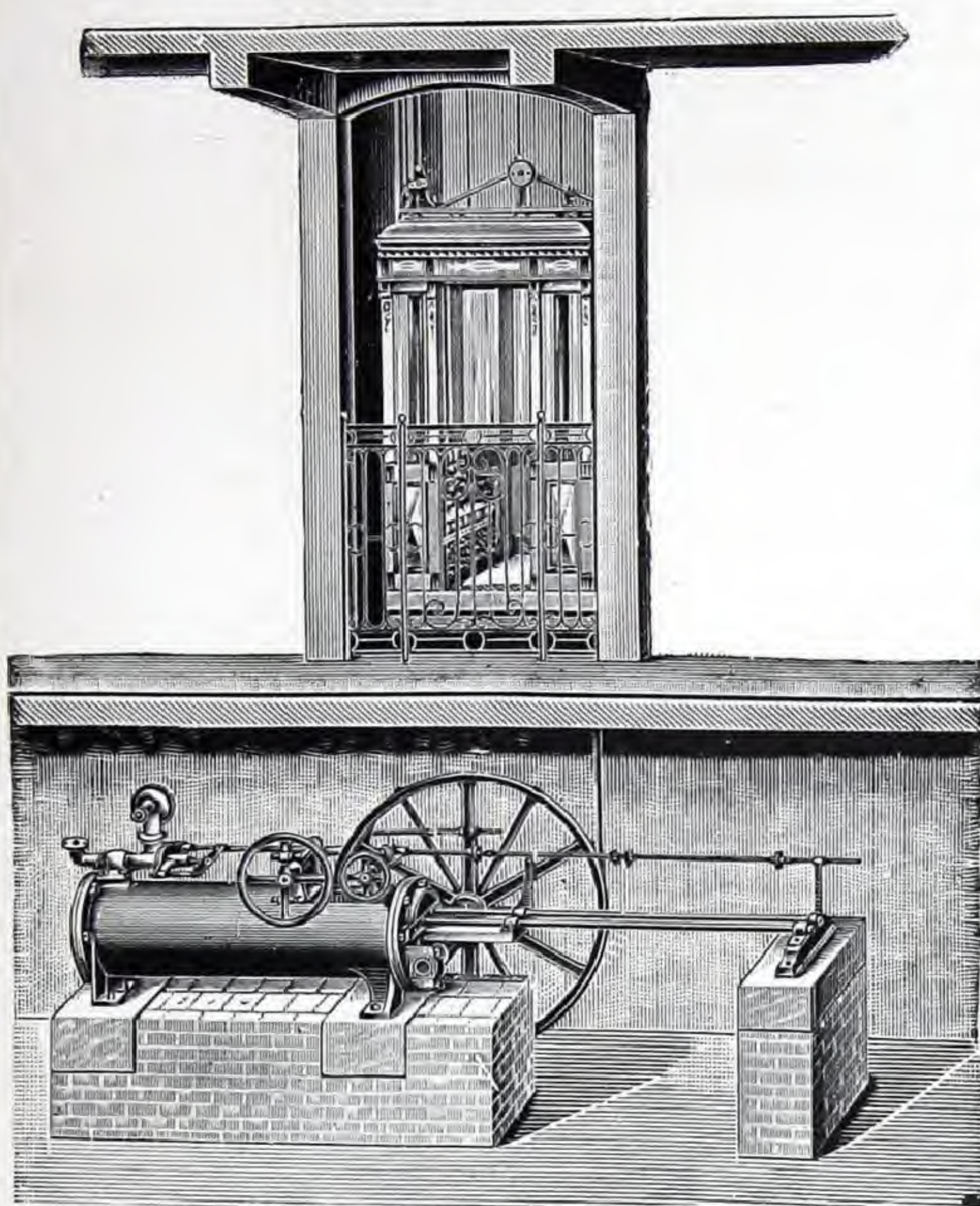
Control Lever Control, Push Button Control, "Stigler" Universal Rope Control

Push Button Control Furnish a private and convenient means of interfloor communication for any kind of building.

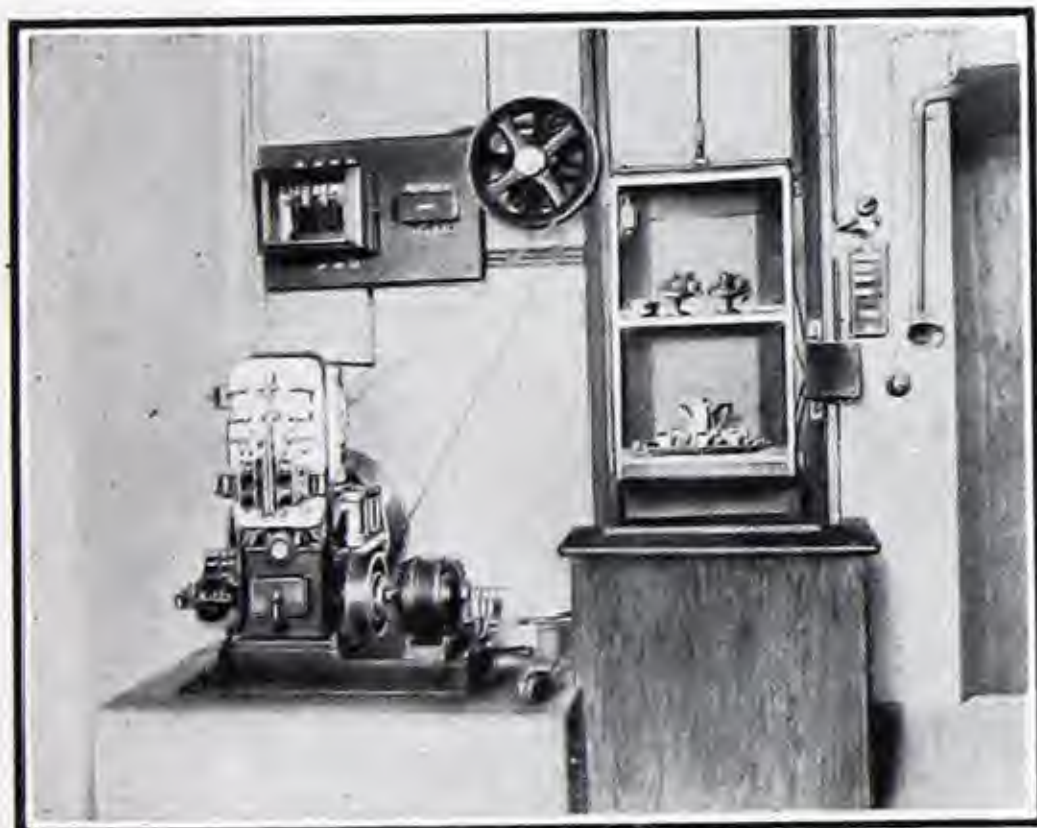
Stigler Universal Rope Control Special Hand Control. An indicator in the car is set for floor desired, the car will then automatically stop at the landing required.

A.C. and D.C. Motors We supply with our elevators either A.C. or D.C. current motors, and owing to our long experience in using both, our customers have option for either one at the same price.

HYDRAULIC ELEVATORS



Plunger Type For single installation and moderate travel.

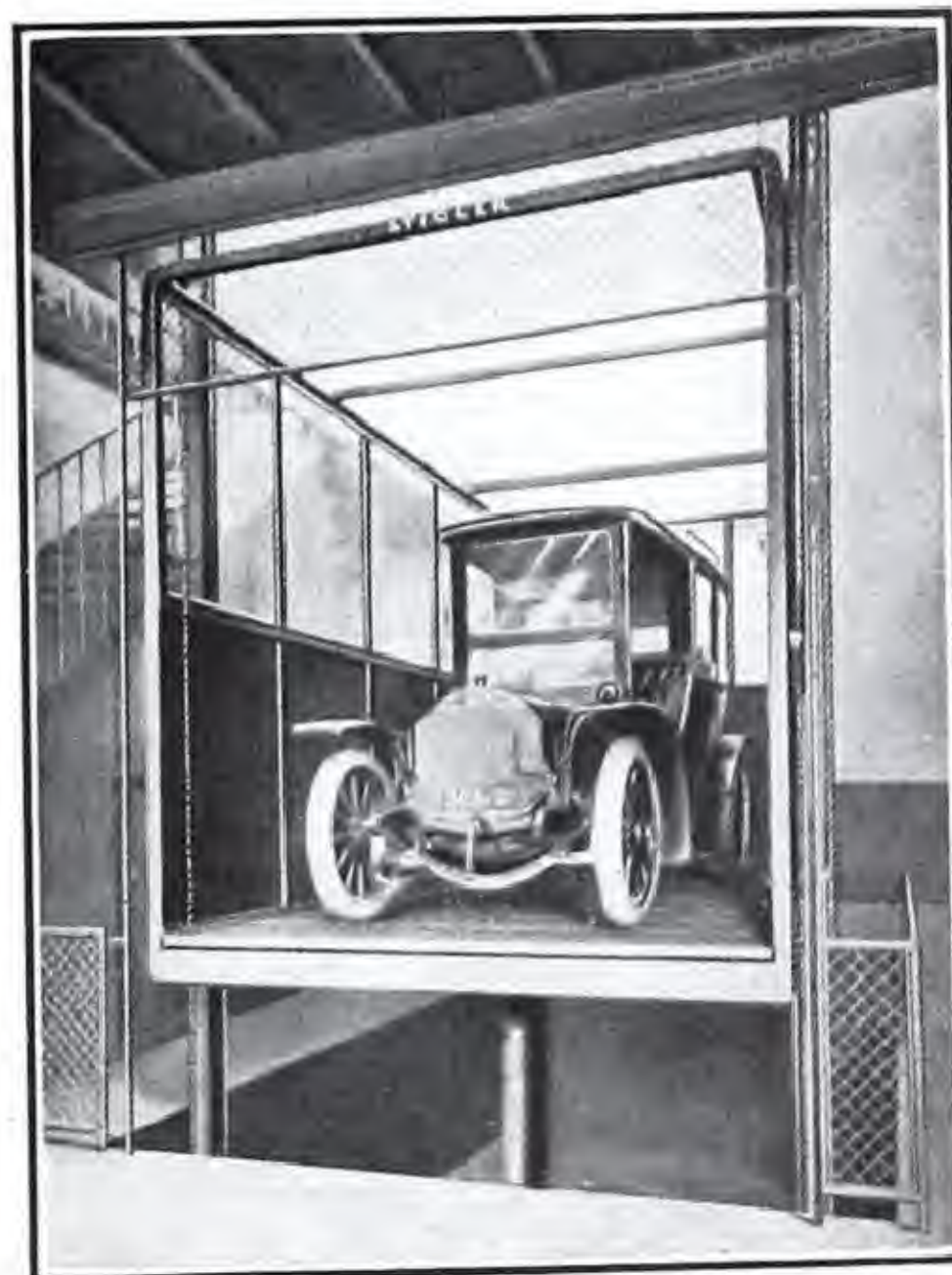


Dumb Waiters

STIGLER ELEVATORS

Stigler Elevators fulfil always the essential conditions of a satisfactory Elevator.

1. No shocks due to starting or stopping, gradual acceleration.
2. The car can be stopped at any point and stops automatically at the exact level of the floor desired.
3. The car stops automatically at the two extreme points of the travel.



We are building dumb waiters electrically operated with rope or push button control. Our standard sizes are for a lifting capacity of 50, 100 and 250 lbs.

Installations All installations are carried out by our expert engineering staff, permanently established in Canada.
Over 17,000 Stigler Elevators are in operation.

Repairs Stigler Elevators in use thirty years without repairs.

Spare Parts We keep on hand a complete stock of all parts subject to wear.

THE H. J. REEDY COMPANY

CINCINNATI, - OHIO

Product Elevators for every need by any power.

Types Among others we build the following types of Elevators.

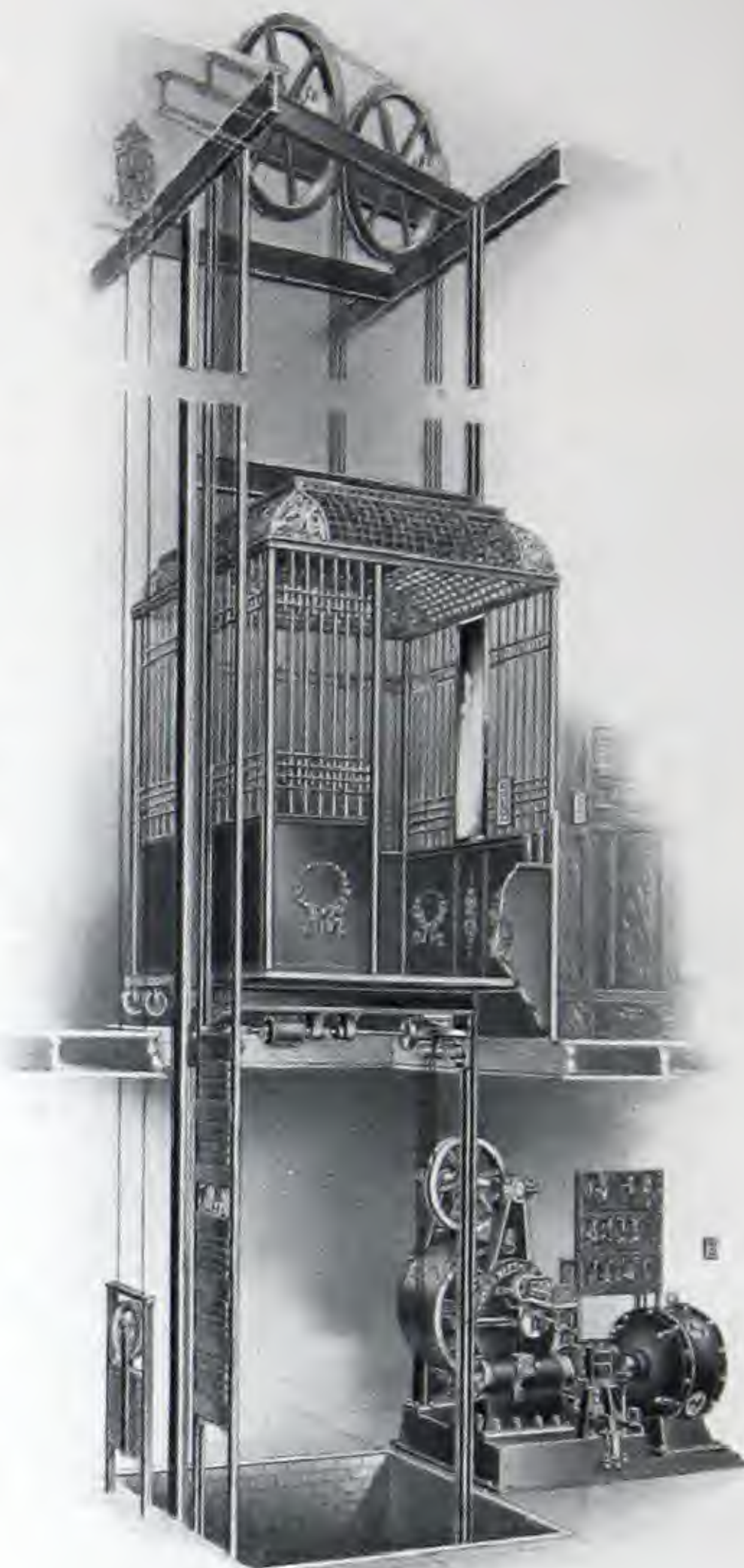
Electrical Types Traction, Direct connected single and tandem worm gear, Helical Gear, Belt connected (6 types), Push Button Elevators, and Dumb Waiters, Automobile and Carriage Lifts, Sidewalk Elevators, Ash Hoists.

Hydraulic Types Direct lift or Plunger type, Horizontal and vertical types, Passenger and Freight.

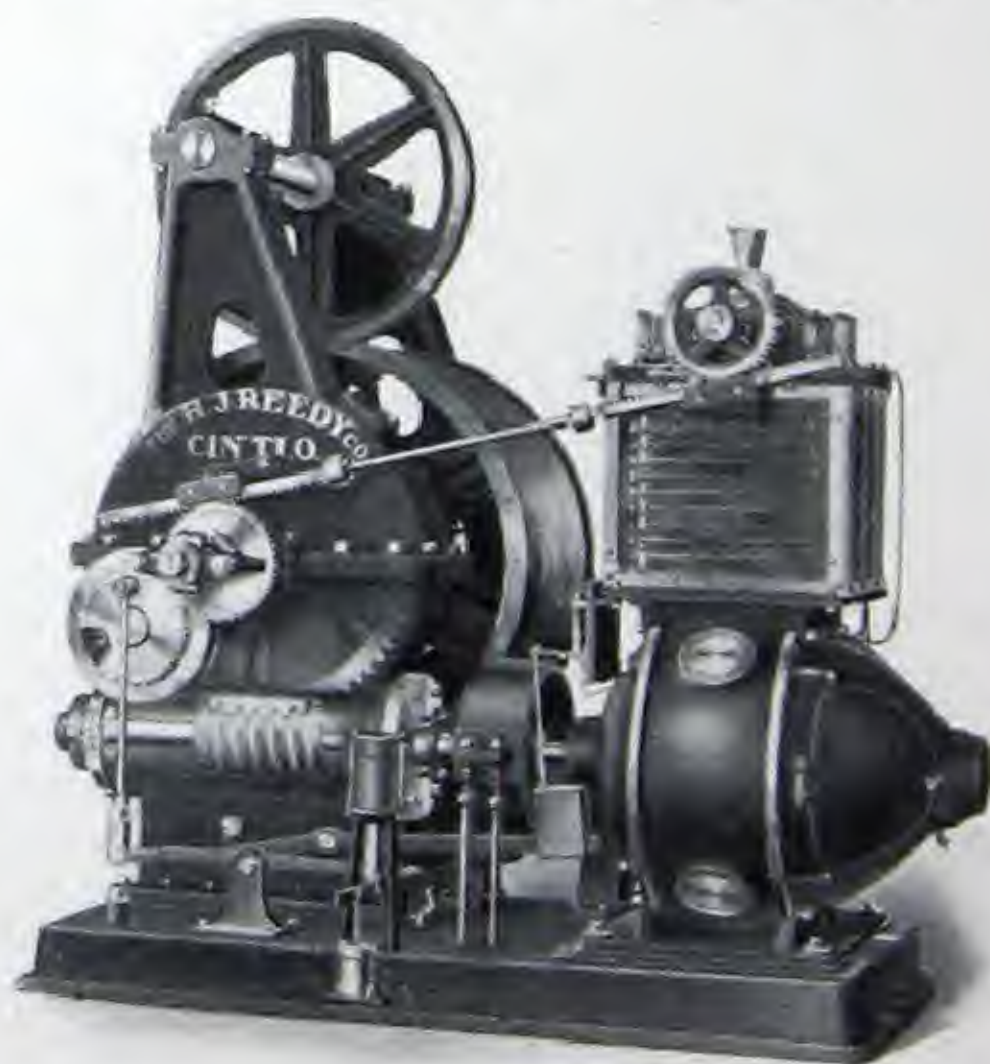
Steam Traction Types Horizontal and Vertical Steam Passenger and Freight Service.

Worm Gear Driven from line shaft, gas Factory Types engine, electric motor.

Hand Power Types Automobile and Carriage Elevators, Invalid and Sidewalk Lifts, Hand Power Freight Elevator (5 types), Dumb Waiters.



Push Button Passenger Elevator. Full magnet control Basement construction.



Direct connected Engine, Mechanical control

Continued on next page

THE H. J. REEDY COMPANY

SUPERIOR QUALITIES OF H. J. REEDY'S ELEVATORS

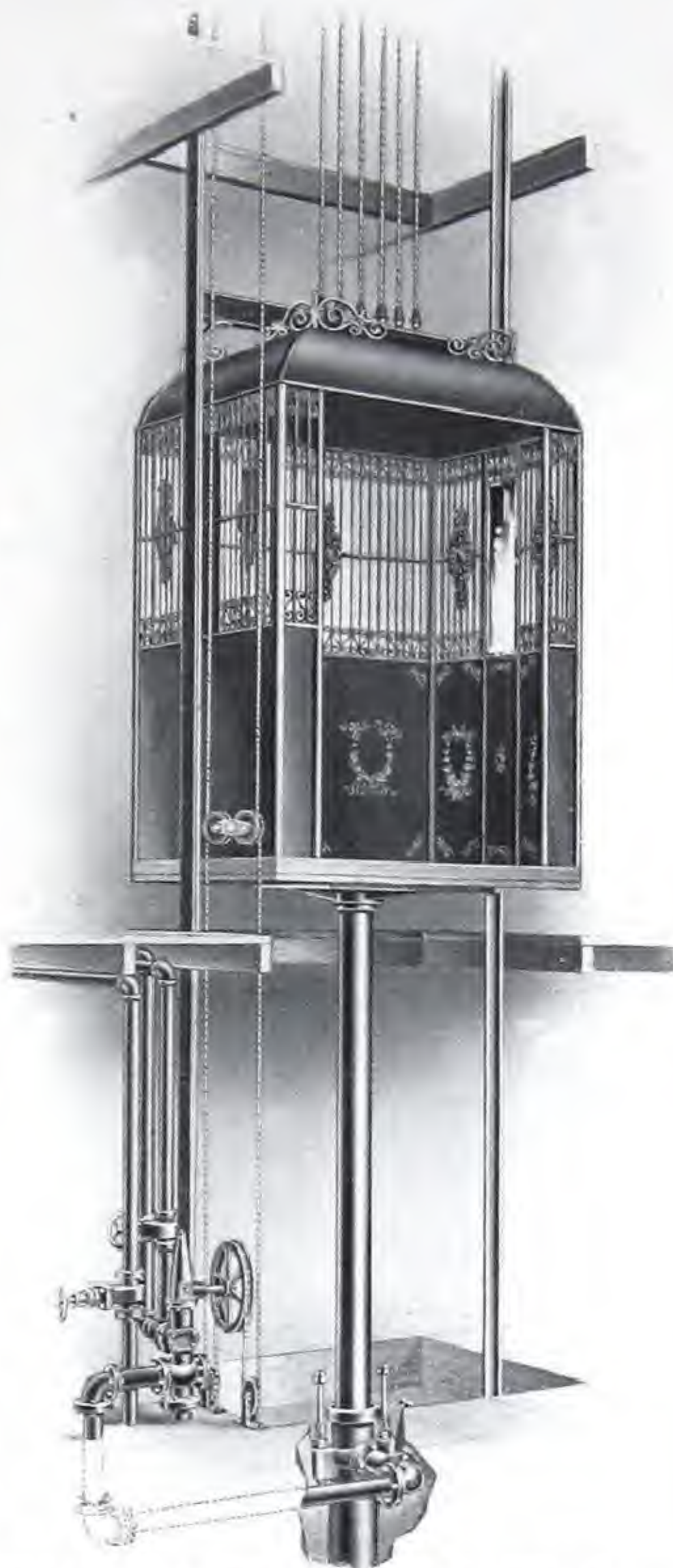
A record of over half a century's experience in designing, building and installing Elevators has proven our machines to be—**The Safest, Most Durable and Economical Elevators** manufactured and operated. They possess without doubt the highest mechanical efficiency and the simplest mechanical design and are massive and solid in construction.

They are noiseless in operation, easily and speedily adjusted and controlled with ease and certainty.

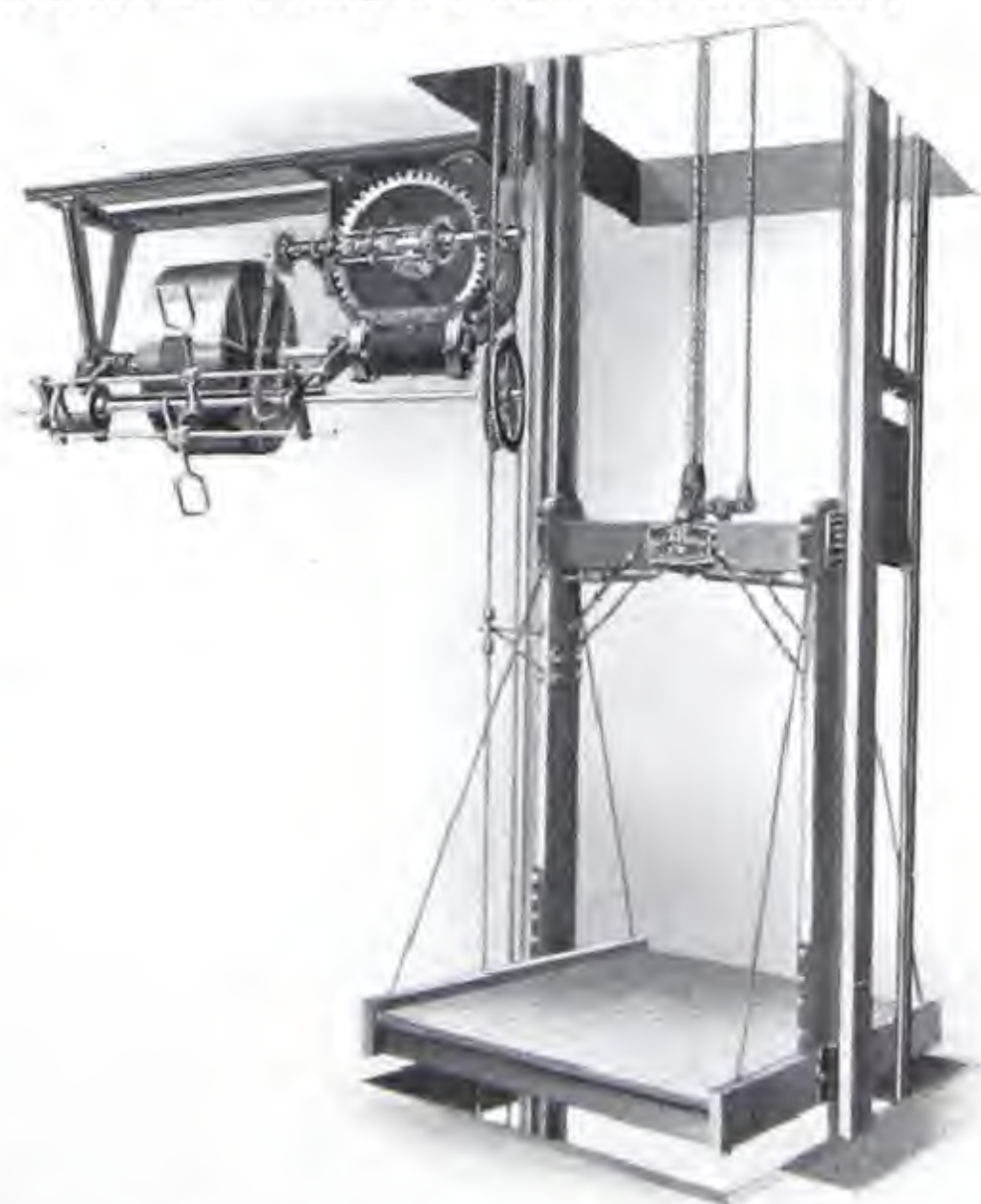
About Our Factory Our factory has been in continuous operation for over 50 years with the result that our product is unexcelled. During that time the Reedy Company has given the public some of the most important improvements in elevator using, including the traction type and Climax Elevator Engine.

Service The Elevator Service in a modern building is a matter of great importance and we take pleasure in inviting Architects and prospective customers to use our large experience in planning elevator installations.

Correspondence Write us and we will gladly send you catalogue, estimate or information as required.



Hydraulic Plunger Passenger Elevator.



Worm Gear Elevator, can be driven from a line shaft with two belts or from a reversible motor.

OTTAWA
Standard Supplies Ltd.
182 Queen St.

ST. JOHN
P. Campbell & Son
73 Prince William St.

AGENCIES:
WINNIPEG
J. L. Nelson & Co.
602 Main St.

CALGARY
Marshall Izlar Supply Co.
P. O. Box 1396

TORONTO
Chapman & Walker
118-120 Richmond St. W.

MONTREAL
A. M. Elliot Co.
301 St. James St.

ROELOFSON ELEVATOR WORKS

GALT - ONT.

“SAFETY FIRST”

Product Automatic Push Button Control for Passenger Elevators and Electric Dumb Waiters.

Elevators for passenger and freight service.

Dumb Waiters, three types, Electric Hydraulic and Hand-Power.



Safety-Gates and Automatic Hatch Doors.

Motors and Controllers for alternating and direct currents. Alternating current single phase detectors.

Efficiency We claim Highest Efficiency in design and Low Power consumption.

Service We maintain a staff of experienced Engineers, and all departments are supervised by Experts.

Enquiry We invite correspondence from Architects, Builders and others interested and will give same prompt attention.

TAYLOR PORTABLE STEEL DERRICKS

Eastern Canada:
Aikenhead Headware Co. Limited
Toronto

Western Canada:
N. J. Dinnen & Company
Winnipeg

Constructed of Malleable Iron and Steel. Weight 197 lbs. Base section, weight 88 lbs.; Beam section, weight 109 lbs. Reach of beam 3 ft. 4 in. Height to block, 5 ft. Beam swings a complete circle on cold rolled steel wheels. Post is mounted on channel steel right angle base, braced with angle steel braces, rivetted to malleable castings that cuff around lugs on post. Drum is revolved by cranks so positioned that one man can reach both cranks. The cable travels over beam, bringing the strain endwise on the beam, thus preventing the big leverage and strain that would obtain if the cable travelled under the beam.



Fig. 2
Beam Section, weight 109 lbs.



Fig. 1

PRICES

Contractors Derrick, as	
Fig. 1, without Rope....	\$65.00
Gondola Derrick for Cars,	
without Rope....	\$85.00
Rope extra, per ft.	.06
Wheelbarrow Chains	\$2.50
extra.	



Fig. 3
Base Section, weight 88 lbs.



Fig. 4
With Gondola Car Attachments.



Fig. 5
With Wheel-Barrow Chains.

Fig. 1 shows Contractor's Derrick complete. Fig. 2 shows operator attaching beam section to base. Fig. 3, Base section and parts. One man can carry either section up a ladder, if necessary. Fig. 4 shows Derrick with Gondola Car attachments ready for attaching to metal or wood Gondola Cars. Fig. 5 shows Derrick equipped with Wheel-barrow chains for hoisting brick and mortar.

The Derrick is tested to hoist 1900 lbs., and one man can operate it as shown in Fig. 5, but two or three men can man the cranks, when desirable. A booklet describing this handy Derrick in complete detail, and showing the many uses to which it can be put, will be sent on request.

VAULTS AND SAFES

GENERAL.

The following specifications are given more as a matter of general information than as a guide in specifying. Owing to the imperative necessity for every possible protection from vaults and safes their construction has become highly specialized, so much so, in fact, that no one without wide experience in such matters is wise to undertake a specification.

MATERIALS.

All the five-ply steel plates and five-ply steel angles specified to be made of 3 layers of low steel and 2 layers of high carbon chrome steel, rolled to finished thickness, and all countersunk screws used for securing outside layers will be of the best welded steel and iron. At the completion, all the five-ply chrome steel angles and chrome steel plates, conical screws used in the construction of the inner doors, outer doors, vestibule, after being fitted shall be taken apart and properly hardened and tempered drill proof and refitted.

All material specified as low or Bessemer steel to have a tensile strength of at least 50,000 lbs. per square inch, to be free from flaws, scale or rust and rolled accurately to gauge.

VAULT LINING.

Dimensions—Inside dimensions of burglar vault lining to be feet inches wide by feet inches deep by feet inches high. The thickness of the lining on all sides, top and bottom to be one and one half inch ($1\frac{1}{2}$ in.) made up in three (3) layers of plates angles, as follows:

Outside or 1st layer, knees and plates—Bessemer steel, $\frac{1}{2}$ -inch (half-inch) thick.

2nd layer, knees and plates—Five-ply Chrome steel, $\frac{1}{2}$ -inch (half-inch) thick.

3rd layer, knees and plates—Bessemer Steel $\frac{1}{2}$ -inch (half-inch) thick.

Construction—Welded Hoops and Knees—

All the outside horizontal edges and corners of lining to be formed of four-inch by four-inch by one-half inch ($4\text{-inch} \times 4\text{-inch} \times \frac{1}{2}$ -inch Bessemer Steel angles—mitred and welded at corners to form continuous hoops entirely around the top and bottom of lining.

Outside Layer—The vertical corners in the outside layer to be formed into right angle knees measuring twelve inches by twelve inches ($12\text{ inches} \times 12\text{ inches}$) on each leg.

Second Layer—The eight corners of this layer to be formed into triangular box knees, bent and thoroughly welded and shaped in right angle triangle mold by hydraulic pressure. These box knees to measure ten inches by ten inches by ten inches ($10\text{ inches} \times 10\text{ inches} \times 10\text{ inches}$). The horizontal and vertical corners between these box knees to be bent into right angle knees in lengths as long as practicable—these to be ten inches by ten inches ($10\text{ inches} \times 10\text{ inches}$).

Third Layer—All horizontal and vertical corners and edges in the third layer to be formed as above into box knees and knees—

size of which to be fifteen inches by fifteen inches ($15\text{ inches} \times 15\text{ inches}$) to insure overlap of joints of second layer of about five inches (5 inches).

Plates.

The panels thus formed between all of these knees as above described in each of the three layers to be filled with plates in as great widths and lengths as possible.

Straightening and Planing.

All plates to be properly straightened by heavy machine rollers or by hydraulic pressure. All edges and ends of the plates to be planed or ground true and straight, and neatly fitted into place.

Joints Alternating and Overlapping.

The lengthwise joints or seams of each layer of plates to be laid at right angles with its next adjoining layer, so as to prevent the possibility of any open joints penetrating the thickness of the lining, and in addition to this precaution all the joints are to overlap at least two (2) inches.

Screws.

The several layers of plates and angles to be securely and closely bound together with strong countersunk screws of hardened chrome steel, three-quarter ($\frac{3}{4}$) inch in diameter, set up with a powerful pawl wrench. The spacing of these screws to commence near all edges and joints, and then be so arranged as to average from centre to centre about twelve (12) inches.

Each series of screws will fasten together two layers of plates only, in such a manner that the screws must not come opposite one another in the different series. The inside of vault lining to be finished smooth and free from projecting bolts and screw heads.

Electric Wires.

If desired, electric wire lead covered cables properly protected and insulated will be built through the vault lining through staggered holes passing along channels in each layer, as many as may be decided upon, and located as desired.

ENTRANCE DOORS AND VESTIBULES.

Outer Door.

The entrance to the before-mentioned vault lining shall consist of a solid steel vestibule with single outer door and folding inner doors, all to be built as follows:—

The outer door to four and one-half ($4\frac{1}{2}$) inches thick, made up in four layers of plates, thus:—

1st layer of Bessemer steel, one and one-quarter ($1\frac{1}{4}$) inches thick, in one plate.

2nd layer of five-ply chrome steel, one (1) inch thick.

3rd layer of five-ply chrome steel, one (1) inch thick.

4th layer of Bessemer steel, one and one-quarter ($1\frac{1}{4}$) inches thick.

Clear walkway through both outer and inner doors to be not less than thirty-two (32) inches wide, by not less than six feet six inches (6 ft. 6 in.) high.

The outer door will swing to the right hand as you face the outside front of the door, or otherwise as directed.

Door Frame.

The outer door frame to be made of six (6) inch by six (6) inch by one (1) inch Bessemer steel square root and edge angle, mitred and thoroughly welded at all corners and into one continuous welded frame, around the entire door, and the abutting edges to be rabbeted where they meet the vestibule plates one-half ($\frac{1}{2}$) inch by one-half ($\frac{1}{2}$) inch. This door frame to be built to a thickness of five inches with various layers of both chrome and Bessemer steel, corresponding approximately to the door, and at least two of these layers in addition to the welded frame shall incorporate knees or angles for securely attaching frame to be body of the vestibule.

Frame Finishing Plates.

The exposed front surface of this door frame shall be covered with low steel finishing plates 12 in. by $\frac{3}{8}$ in. thick, same being attached to the angle frame by flat hexagon head steel tap bolts and washers, polished or nickel-plated. Edges of finishing plates to be finished quarter round and the top corners to meet on an accurate mitre running direct to the corner of the frame. Same to be finished to correspond with crane hinge finish.

Jambs and Packing.

The various layers of plates of the door and frame to be set up on their jambs to form rabbets ($\frac{1}{2}$ inch wide) and also the jambs to be formed into a set of continuous tongues and grooves, with their edges serrated and packed with usdurian or flexible rubber. The door jambs to have good metallic bearings against the frame jambs, the object being to make a securely air-tight joint when the pressure bars operating the door force same into its bearings. The first or outside rabbet shall also be packed with flexible or usdurian rubber, so that door and frame have two complete rows of packing.

Screws.

All plates in the doors and door frames to be fastened to each other with three-quarter ($\frac{3}{4}$) inch and one (1) inch diameter counter-sunk screws of hardened chrome steel, space not to exceed about ten (10) inch centres, and along the edges and jambs about eight (8) inch centres, and in addition, to more securely bind the door together, also to secure the lock-bolt frame to the door, conical bolts with one (1) inch diameter parallel parts and threads shall be built solid into door, the conical heads to start at the third layer, and to be spaced on about six (6) inch centres.

Crane Hinge.

Door to swing on improved crane hinges of scroll pattern, revolving on hardened steel ball bearings in the bottom, and hardened steel rollers around the top of the hinge shaft.

Hinge and bearings to have highly polished steel finish, or to be rubbed to a smooth hard surface and finished with aluminum bronze, as desired.

Pressure System.

Door to be equipped with two (2) powerful eccentric lever revolving pressure bars for forcing door firmly into place against the rubber packing. This pressure mechanism to be operated by hand wheel actuating bevelled or worm and gear connections, said gear connections all to be incased in round steel drum bearings, and the two eccentric bars to have necessary door and frame bearings and fulcrum blocks—all to be accurately fitted and securely fastened to the door and frame.

Bolt Work—Outer Door.

The bolt work to have bolt frame continuous around the door of three (3) inch by two (2) inch steel, through which shall shoot at least twenty-four round steel revolving locking bolts one and three-quarter ($1\frac{3}{4}$) inches in diameter, locking behind all four edges of the door frame. These locking bolts to be made revolving to prevent sawing, drilling or cramping. The horizontal lock-bolts to be shouldered into rectangular carrying bars two (2) inches by one and one-quarter ($1\frac{1}{4}$) inches, so attached to flat guide bars as to make it impossible for any lock-bolt to become disconnected. The whole to be operated by one suitable lever handle or wheel. The inside surface of the door underneath the bolt work shall be covered with brass chased plate, lacquered.

Combination Locks.

The whole, when locked, to be held secure by two first-class four-wheel Sargent & Greenleaf locks. The locks to have black and white enamelled or nickel-plated dials, and outside geared spindles covered with reinforcing bars securely held to the door, and the ends of the spindles to make a close fit against these reinforcing bars, to prevent driving.

As protection against a lock-out, these locks are to be so arranged with dogging device so that either lock on having its bolt retracted will release the bolt-work and permit the door to be opened. This device also to be arranged so as to prevent force being used against the locks themselves.

Spindles.

The lock and bolt throwing spindles to be made up in part of welded steel and iron, and to have enlarged centres, and be fitted with special expanding nuts, so that they can neither be pulled, driven or drilled, and these spindles to be ground in to protect against liquid explosives.

Triple Time Lock.

If required this outer door also to be fitted with a first-class triple chronometer Sargent & Greenleaf time lock, with Sunday and holiday movements, and the usual guarantee furnished.

Plate Glass Door.

The outer door to have a covering of French plate glass over the entire boltwork, to be fitted into a highly polished steel frame,

hinged to allow its being opened about eighty degrees at least, and secured by a flat key lock.

Inside Doors.

The inside folding doors shall be one and one-half ($1\frac{1}{2}$ in.) inches thick in three layers of plates, as follows:

1st layer of Bessemer steel, one-half ($\frac{1}{2}$ in.) inch thick.

2nd layer of 5-ply Chrome steel, one-half ($\frac{1}{2}$ in.) inch thick.

3rd layer of Bessemer steel, one-half ($\frac{1}{2}$ in.) inch thick.

These inside folding doors shall be in two halves, opening in the center; the plates shall be fastened together with $\frac{3}{4}$ inch diameter hardened Chrome steel screws, as previously specified for outer door; the edges of the various layers of plates of the doors and their frame shall be planed true and straight and set up so that their jambs will form rabbets $\frac{1}{2}$ inch wide at both sides, top, bottom, and center joints. These doors shall swing on heavy pin hinges with special anti-friction bearings.

Bolt Work—Inner Door.

The bolt work of each door to have continuous bolt frame of two and one-half ($2\frac{1}{2}$ in.) inches by one and one-half ($1\frac{1}{2}$ in.) inch steel, through which shall shoot at least twenty round locking bolts one and one-half ($1\frac{1}{2}$ in.) inch diameter, locking behind all four edges of door-frame, and also at the center joint the locking bolts of the right-hand door are to shoot forward and enter the lockbolt holes in the bolt frame of the left-hand door; and otherwise the lockwork to be similar to the outer door in effect.

The inside surface underneath the lockwork shall be covered with brass-chased plates, lacquered.

Spindles.

The lock and bolt-throwing spindles to be the same as the outer door, and protected in the same manner, but of proportionate sizes.

Vestibule.

The sides, top and bottom of vestibule between outer and inner door frames shall be two and one-half ($2\frac{1}{2}$ in.) inches thick, built up in four layers of plates, as follows:

1st layer of Bessemer steel 1 inch thick.

2nd layer of 5-ply Chrome steel $\frac{1}{2}$ inch thick.

3rd layer of 5-ply Chrome steel $\frac{1}{2}$ inch thick.

4th layer of Bessemer steel $\frac{1}{2}$ inch thick.

This vestibule shall be of proper depth to suit the thickness of the front masonry wall of the vault. It shall be so constructed as to be thoroughly attached to and become part of the outer and inner door frames and vault lining, and shall have sunk flooring and low outer door solid sill. The various layers of plates shall be fastened together and to the return knees from outer and inner door frames with $\frac{3}{4}$ inch and 1 inch diameter hardened Chrome steel vault screws spaced as specified

for the outer door, and inside surface shall be finished smooth and free from projecting bolt or screw heads.

Cement.

Between each plate forming the several layers of the sides, top and bottom of vestibule, also the outer door and the two inner doors, there will be interposed a thin layer of hardening cement. This cement to be slow setting, and to completely cover the surface of the last plate before the next is screwed up and secured to it. This is done wherever possible while the plates are lying in a horizontal position.

Day Gate—Polished Steel.

The entrance to vault to be provided with a heavy, highly polished steel day gate of approved design, constructed of upright round steel bars and suitable flat bar framing, secured with latch lock and alarm gong to strike when opening. The gate to be hung upon a folding leaf, to open outwardly, and to fold back into vestibule at night when doors are closed.

Platform.

The vestibule to have a platform to be of light wrought iron, so extend from floor of vault outwards and rest upon the outer break of outer door jamb, to make a level walk through the entrance. The upper surface to be covered with corrugated rubber.

Finish.

All work to be free of rust and oil, and all plates, bars and angles (exclusive of polished or plated work) to have at least one coat of mineral paint and oil on all parts before being put together.

The inside of vault lining and vestibule to have, in addition to the usual priming coats, three coats of white lead and linseed oil. The heads of screws and rivets to be well and neatly puttied before being painted with the white coats.

The outside of doors and frame of vestibule to be filled and rubbed to a perfectly smooth surface, and then finished in aluminum bronze, flat black or enamel colors, as may be directed.

The entire boltwork of both outer and inner doors to have hand polished steel finish.

The entire pressure system fittings of outer door, together with all hinge tips, hand levers, door pulls, etc., to be nickel-plated.

The entire jambs of both outer and inner doors and their respective frames shall have hand polished steel finish.

The crane hinge and bearings of the outer door shall have hand polished steel finish or be filled and rubber to perfectly smooth surface and finished in aluminum bronze, as desired.

Drawings.

Drawings Nos. _____ accompany and are to be considered a part of this specification.

AHERN SAFE COMPANY, LIMITED

MONTREAL, QUE.

Established 1880

Illustrations

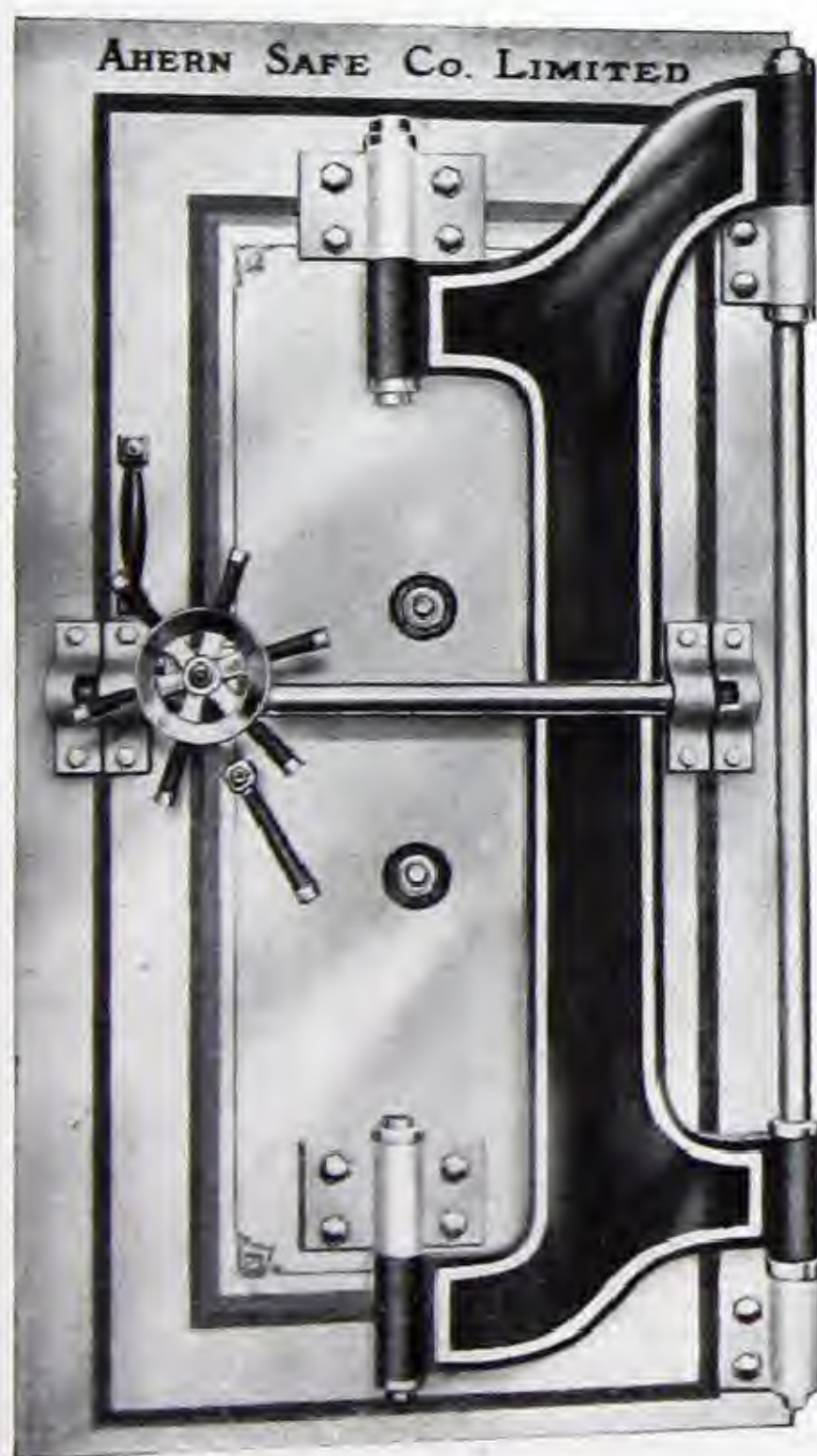
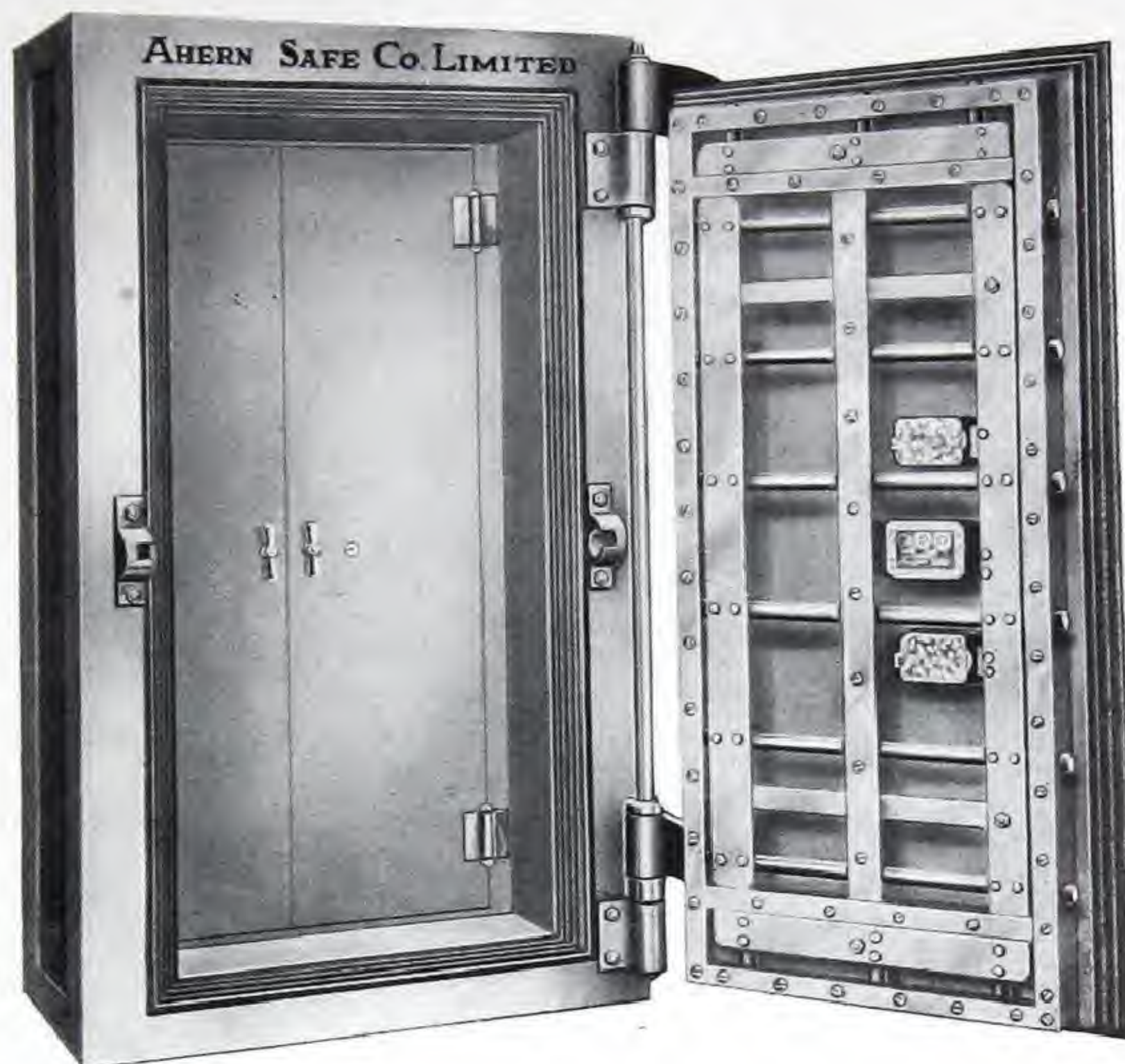
Illustrations show standard Banker's Steel Vault Door which may be made in any desired thickness.

Specialty

We make a specialty of installing complete Safety Deposit Vaults.

Doors

Fireproof Vault Doors of various styles carried in stock.



WE MAKE . .

FIREPROOF VAULT DOORS
BANKERS STEEL VAULT DOORS
STEEL VAULT LININGS
SAFETY DEPOSIT BOXES
FIREPROOF SAFES
BANKERS' SAFES
GRILL WORK
PRISON AND JAIL WORK

Write for complete illustrated catalogue.

AHERN SAFE COMPANY, LIMITED

Offices and Factory, Dagenais Street

Showrooms: 390 St. James St.

- Montreal, Que.

THE GOLDIE & McCULLOCH CO., LIMITED

Head Office and Works: GALT, ONT., CAN.

Branches and Agencies:

Toronto Office
1101-2 Traders Bank Building

Western Branch
248 McDermott Ave., Winnipeg, Man.

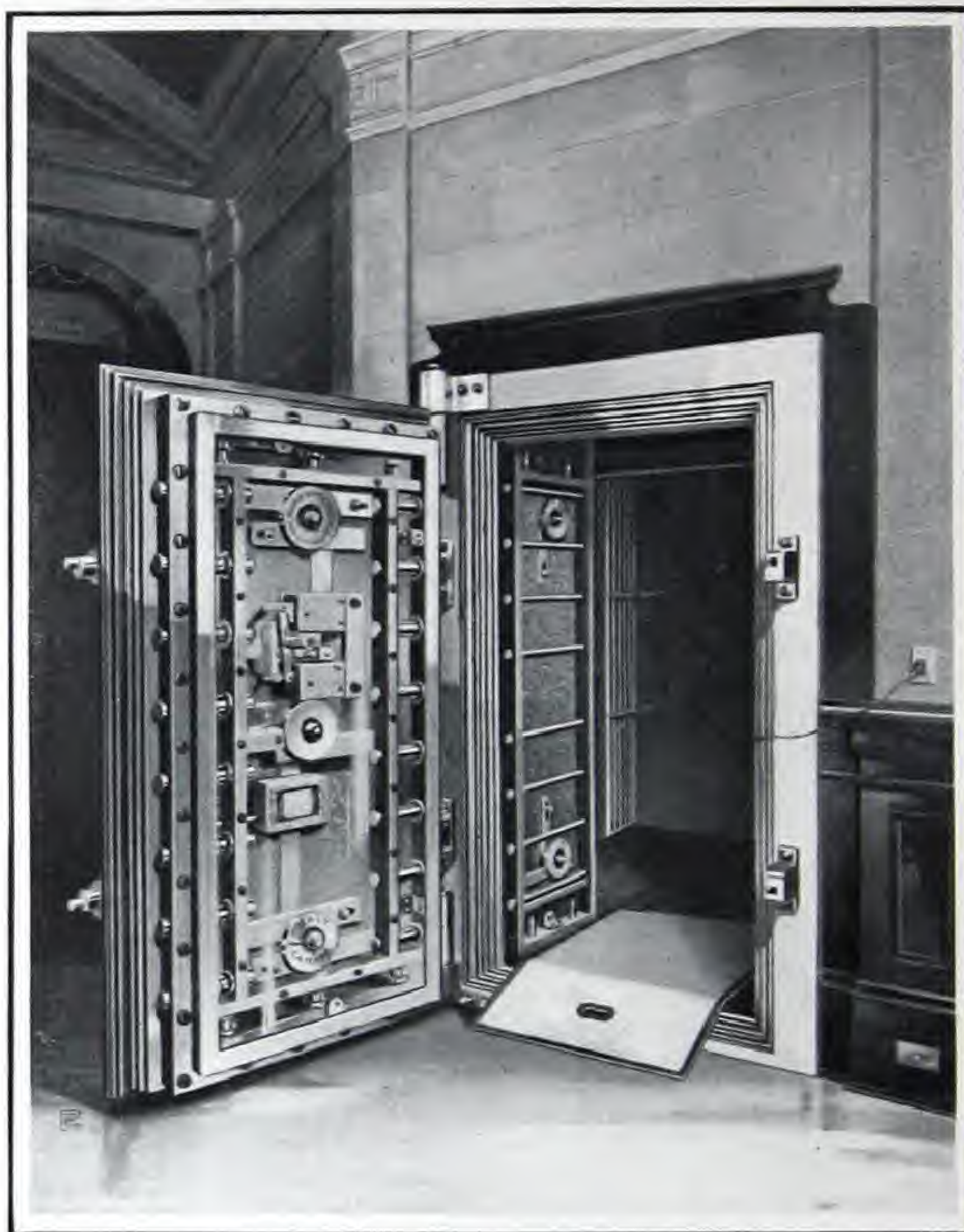
Quebec Agents
Ross & Greig
412 St. James St., Montreal, Que.

B. C. Agents
Robt. Hamilton & Co.
Bank of Ottawa Bldg., Vancouver, B.C.

Fire-Proof Safes and Vault
Doors. Bankers' Safes and
Vault Doors. Prison Cells,
Etc.

Illustration

Shows the Vault of the Dominion Bank, at Vancouver, B.C. This Vault with its modern interior equipment, and heavy Inner and Outer Doors, fitted with two double acting four-wheel combination locks and time lock is only one of a great many splendid similar equipments built by us for the leading Banking and Monetary Institutions of Canada.



- Quality** Is the first consideration in the manufacture of G. & McC. Co. Safes, Vaults and Vault Doors. Expert designers and mechanics along with the best grade of material obtainable are used in their construction.
- Facilities** We are equipped to turn out anything in the Safe or Vault line, from the Ordinary Fire-Proof Safe or Door to the heaviest and most elaborate Burglar Proof Vaults.
- Catalogues** Our combined Safe and Vault Catalogue and complete estimates will be gladly furnished upon request and receipt of particulars.

J. & J. TAYLOR, LIMITED

Toronto Safe Works

TORONTO,

CANADA

(Established 1855)

Branches:—MONTREAL

WINNIPEG

VANCOUVER

EDMONTON

Products

Designers and Manufacturers of Safes, Vault Doors, Bank Vaults, Safety Deposit Vaults, Deposit Boxes, Combination Locks, Extra Heavy Security Bank and Safe Deposit Vault Work.

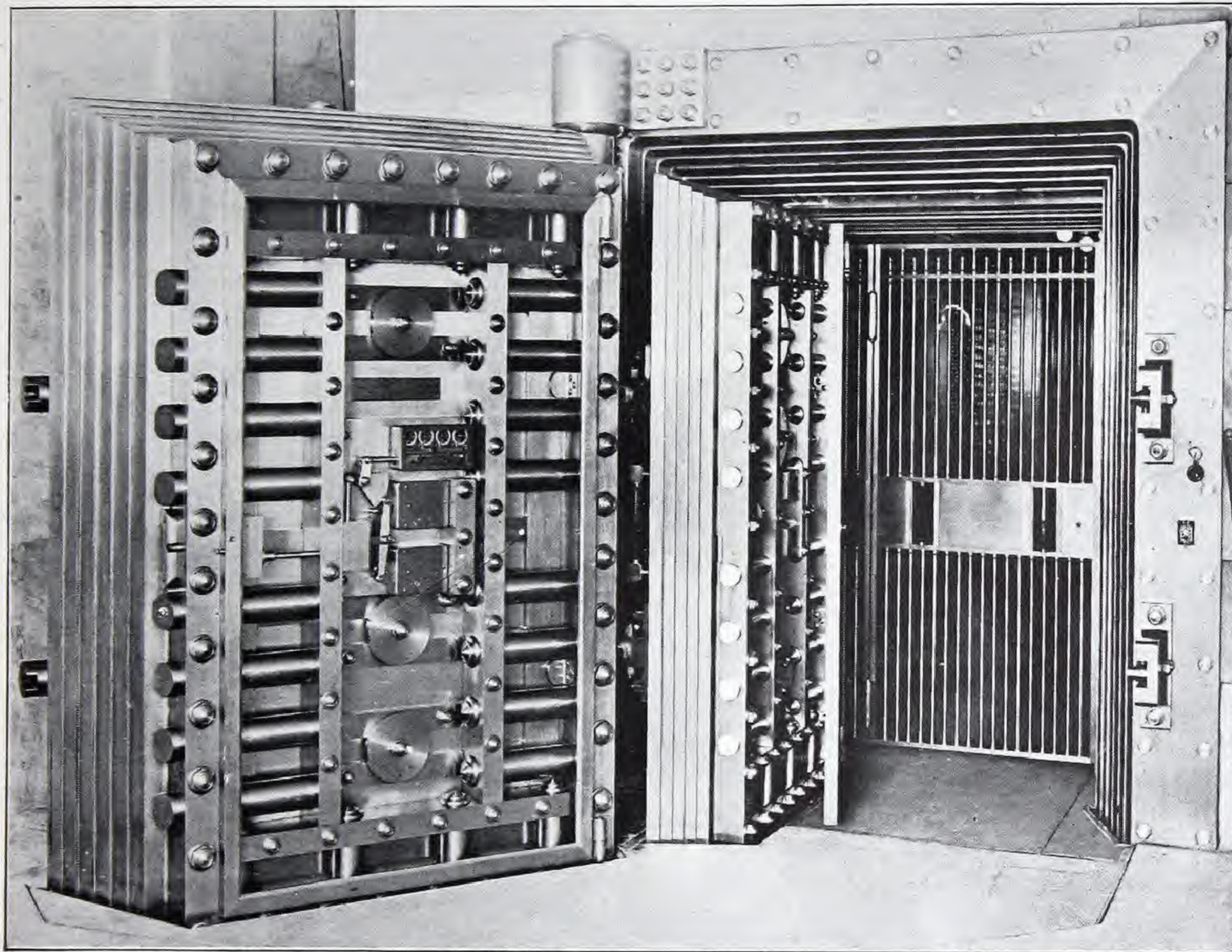


Illustration Vault Doors supplied for Bank of Montreal and Royal Trust Company, Winnipeg. The heaviest and most modern Vault Doors constructed anywhere at the time they were completed. Outer door 18 inches thick, Inner Door 8 inches thick, Vestibule 7 inches thick, Vault Lining 4 inches thick. Also 24 inch concrete walls with double row of railroad iron embedded.

Equipment We have specialized in this trade solely for fifty-nine years—no other interests—and have the most complete and up-to-date machinery and appliances for handling all classes of safe and vault work.

Specifications Safes are of three types—Fireproof (for resisting fire), Combined Fire and Burglar (for resisting both fire and thieves), and Burglar (for resisting attacks from burglars only). Vault doors are similarly classified—both Fireproof and Fire and Burglar combined.

We are glad always to assist in the compiling of detailed specifications with necessary drawings for all classes of Vault and Safe Work.

VACUUM CLEANERS

VACUUM CLEANING PLANT.

Provide (and install) ready for operation a _____ outlet, or sweeper, vacuum cleaning system, with all fittings, tools, hose, motor and other appliances necessary to a complete working equipment.

The vacuum producer to be of the turbine (rotary, reciprocating, diaphragm, steam ejector, water ejector) type, to maintain a vacuum of _____ inches of mercury at the machine with all or part of the total number of outlets in operation. The plant to have sufficient capacity to exhaust _____ cubic feet of free air per minute per cleaning tool or outlet. The power required for the above duty shall not exceed _____. (Specify the method preferred for the disposal of exhaust from the vacuum machine. Whether dust is to be filtered out by dry cloth filter and air discharged within the building; dust removed by "wet filters"; or the exhaust taken outside the building to suitable receptacle or to sewer.)

The motor furnished to be direct connected, or silent chain drive; to be for alternating (direct) current, _____ volts, _____ phase, _____ cycles; equipped with suitable starting devices for control at the machine (on each floor). After operating continuously for an hour at full load the heating must not exceed (90 degrees) at the commutator, (75 degrees) in any other part.

(When steam drive is to be used state pressure disposed to be made of exhaust and all other available details. For water motor drive state head in feet, discharge, etc. Where hydraulic turbine plants exist satisfactory vacuum cleaning can be obtained by simply taping the draft tube and putting in a hose connection.)

The pump and motor to be mounted on a suitable cast iron or concrete sub-base and firmly bolted in position.

A complete set of cleaning tools, consisting of _____ to be furnished for each outlet, together with _____ feet of _____ inch non-collapsible hose, as light as possible consistent with good service, with proper couplings, etc. Hose connections to be on base boards and of a finish to be approved by the architect.

PIPING.

The contractor to furnish and install a system of vacuum piping to consist of risers and the necessary horizontal piping to connect said risers with the vacuum producer, all as shown on plans or described below.

All vacuum pipe to be standard, full weight (galvanized) wrought iron. Ends of all pipe to be reamed smooth inside after cutting and slightly counterbored. All joints to be screwed up tightly, with a mixture of black asphaltum and graphite, so that pipe shoulders in fitting. All fittings to be black or galvanized cast iron, with long sweep bends.

Laterals or long ben T's are to be used in risers where branches are taken off for inlets. This also applies to the top branch. The tops of risers are to terminate in plugged T's for cleanouts, or for extensions.

In addition to the cleanouts to be provided in the fittings as described below, there is to be a cleanout every forty feet in the horizontal pipe, even if it is necessary to place a T in the line for this purpose only.

In the case of exposed joints or those that will be accessible without cutting away permanent work, 45 degree turns in a line are to be made with a 45 degree Y, 90 degree turns in a line with a T-Y; and offsets with two 45 degree 's, with the unused opening in each case plugged for a cleanout.

Pipe sizes to be such as the manufacturer recommends as satisfactory, or as shown on drawings.

In the case of concealed joints that are inaccessible except by cutting away permanent work, use long sweep elbows instead of the plugged fittings.

Risers to be securely stayed by means of suitable clamps about every twenty feet, depending upon conditions, and horizontal piping to be hung from the ceiling by means of malleable iron pipe hangers placed approximately every fifteen feet.

The horizontal lines to have a slope of one in fifty from the foot of the risers toward the vacuum pump.

The entire suction piping to be tested to 40 pounds per square inch air pressure without showing a drop on the gauge for an hour.

INSTRUCTIONS.

The contractor is to give full instructions to the proper parties regarding the care and operation of the apparatus and the cleaning tools.

GUARANTEE.

Contractor shall guarantee the system for one year against defective material or workmanship, and that the material and workmanship throughout will be of the highest standard and so arranged as to give the best practical results.

SPECIFICATIONS FOR STRUCTURAL IRON AND STEEL

GENERAL.

All structural iron or steel shall be the best of its kind, both as regards quality of material and manufacture, and shall strictly comply with plans as regards dimensions.

WEIGHTS.

A variation of two and one-half per cent. ($2\frac{1}{2}$) for steel and three per cent. (3) for cast-iron from the estimated weights will be allowed in the finished material. Any individual member or piece of material which weighs less than the estimated weight and this allowance, may be condemned at the discretion of the architect, and any classification of material which exceeds this estimated total weight of such class by more than the variation allowed will not be paid for.

CASTINGS.

All castings shall be of tough gray iron, free from all shrinkage-cracks, blow-holes, cold-shuts, sand, cinder or other defects, clean, true to pattern, and neat as to finish. Only such scrap iron as may be approved by the architect or his inspector shall be mixed with the metal used for casting. Castings shall be allowed to cool slowly in the sand to avoid shrinkage-strains.

Two specimens, each 1 inch square, shall be cast for each furnace heat as runners on different castings or from separate parts of the pour, and shall be capable of sustaining a central load of 2,500 lbs. when set of knife-edge supports 12 inches apart, with a deflection not less than $\frac{3}{16}$ of an inch, and when turned to a diameter of about $\frac{3}{4}$ of an inch for a distance of 4 inches shall develop a tensile strength of at least 18,000 lbs. per square inch. A blow from a hammer upon the rectangular edge of any casting shall result in an indentation without flaking the metal.

COLUMNS.

The thickness of any part of the shell shall not vary more than $\frac{3}{16}$ inch from any other part, nor more than $\frac{1}{16}$ inch less than the thickness specified.

FILLETS.

Brackets and flanges shall be boldly filleted, and in no case with fillets of less than ($\frac{1}{2}$ in.) radius.

STEEL.

All steel shall be uniform in quality, and manufactured by the (open-hearth) process. Chemical analyses for each original furnace heat shall be made and furnished by the rolling-mills.

Steel shall not contain more than .08 per cent. of phosphorus, nor .06 per cent. of sulphur.

Rivets shall be "soft" steel, and all other steel shall be of "medium" quality as specified below.

TESTS.

Rolling-mills shall furnish two test specimens cut from finished material of each original furnace heat, to identify which all material shall be marked with the number of the original furnace heat from which it is rolled. One specimen for each heat shall be broken by tension in a testing-machine, and shall show in pounds per square inch an ultimate strength of from 60,000 to 68,000 lbs. for "medium" steel and 52,000 to 60,000 lbs. for "soft" steel; an elastic limit of at least one-half the ultimate strength; and an elongation in 8 inches of at least 25 per cent. If the first specimen fails to fulfil the above requirements, four other specimens may be tested at the discretion of the inspector, and if two also fail, all material rolled from such furnace heat shall be condemned. The second specimen shall be tested by bending one end cold, and the other end shall be heated cherry-red and quenched in water and bent; both bends shall be 180 degrees flat without flaw.

FINISH.

Finished material shall be straight, true to section, with smooth clean surface, and free from cracks, seams, buckles, or other defects.

INSPECTION.

The rolling-mills shall furnish all test specimens, and the use of testing-machine, together with all labor necessary for handling material for inspection, without charge. No shipment shall be made without at least two days' notice to the architect or his inspector, and in the event of shipment from mills without such notice, or without proper facilities for inspection, the cost of subsequent inspection at the shops of material so shipped shall be paid by the rolling-mills.

WORKMANSHIP.

All workmanship shall be first-class in every particular, and in accordance with the best modern shop-practice.

PLANTS.

All working shop-plans shall conform to the plans furnished by the architect, and must bear his signature of approval before work commences. Such approval, however, shall not relieve the shop from the responsibility of correcting, without charge, any errors in not following the architect's plans, or errors of "clearance" or "connections" which can be discovered by examination.

At least two sets of working plans and two copies of order lists of material shall be furnished the architect.

SHOP-WORK.

All machined surfaces of castings shall be accurate and smooth. Columns shall be of exact height, with bearing surfaces at right angles to the axis of the column. Connection-holes shall be accurately spaced and drilled to exact position, if necessary to an iron template, in order to provide for tight-fitting turned bolts. The depth of bracket-web shall be twice the horizontal projection.

PUNCHING.

All rivet-holes shall be accurately spaced in a true line, and laid out by template. The clearance between die and punch shall not exceed 1/32 inch for material 1/2 inch thick, nor 3/64 inch for thicker material. Holes shall be clean-cut without cracks, and burrs shall be removed by a countersinking reamer.

Built girders shall have rivet-holes punched 1/8 inch small, and holes shall be reamed to full size with parts in position.

STRAIGHTENING.

The material for all built members shall be straightened after punching.

ASSEMBLING.

At assembling, and before riveting, built members shall be truly straight and out of "wind," held by a sufficient number of bolts to prevent warping or bending under handling and riveting. No drifting of holes shall be done under any circumstances in any class of work, and failure of holes to match shall be corrected by new material or by reaming, at the discretion of the architect or his representative.

RIVETS.

Rivets shall be of soft steel driven by machine wherever practicable. They shall completely fill the holes and be tight with neat cup-shaped heads concentric with the holes and free from cracks at edges. Rivets showing evidences of burning will be rigidly condemned. In removing defective rivets, any injury to the material will be cause for condemnation of injured parts.

CONNECTIONS.

All joints shall be fully spliced.

All framed beams shall be secured in position by angle-brackets and standard connections.

Connections shall be made by rivets or turned bolts fitting tight, as shown on plans.

Any beam or girder that is longer or more than 1/2 inch shorter than required for its special place shall be rejected. The accurate adjustment of the lengths of framed beams shall be made by reaming connection-holes and setting out angle-brackets at their ends to correct length.

PAINTING.

All metal-work shall be free from dust, dirt, and scale; no painting shall be done in wet or freezing weather. Except for cast-iron, all surfaces in contact and all places inaccessible at erection shall be painted one coat of paint at assembling, and finished members shall be

painted one coat before shipment. After erection, all surfaces, including cast-iron, shall be painted one thorough coat. The paint used shall be the _____ made by _____, and it shall be well brushed on and worked over the entire surface.

ANCHORS.

All beams resting on walls are to be securely anchored by approved T anchors built into the wall.

GENERAL DIMENSIONS.

Height shall be distance from top of column foundations to bottom chord or trusses and shall be _____ feet. Width shall be extreme outside measurement and is _____ feet; also length outside _____ feet.

DRAWINGS.

Contractor shall furnish complete working drawings, details, stress sheets and data used in design for approval before beginning fabrication or ordering materials. He will be held responsible for dimensions and design, and approval by architect does not relieve him of responsibility.

SNOW LOAD.

Specify the snow load in pounds per square foot for the locality, as given by the various weather bureaus or observatories.

WIND LOADS.

Wind loads vary with locality, but may generally be calculated (for roofs) by Duchemin's formula

$$W = P \times \frac{2 \sin A}{1 + \sin^2 A}$$

Where W = normal wind pressure in pounds per square foot.

P = 30 pounds per square foot in ordinary cases and 40 pounds per square foot in exposed places.

A = angle of inclination of roof with the horizontal.

Or the formula:

$$W = \frac{P \times A}{45}$$

gives satisfactory results when the pitch is 45 degrees or less.

Wind loads on walls may be taken as 20 pounds per square foot when the height under the eaves is 30 feet or less, and 30 pounds per square foot of exposed wall when height under eaves is 60 feet, and other heights in proportion.

WEIGHT OF TRUSSES.

Truss weights per square foot of horizontal projection are obtained by the formula:

$$W = \frac{P}{45} \left(1 + \frac{L}{5 \times A \frac{1}{2}} \right)$$

Where W = weight of truss per square foot of horizontal projection.

P = capacity of truss in pounds per square foot of horizontal projection.

L = span in feet.

A = distance between trusses in feet.

ROOFING WEIGHTS.

Roofs should conform with best roofing practice, and weights used for calculation should be the actual weight of the kind of roof used reduced to weight per square foot of horizontal projection. In mill buildings, corrugated steel is the commonest roof. Weights of corrugated steel are given in the chapter on roofing materials.

MISCELLANEOUS LOADS.

Weights of all sheathing, purlins, bracing, ventilators, cranes, and so forth, must be calculated and included in the dead loads.

CORROSION.

Where steel work will be exposed to the action of steam, moisture, acid fumes, or any corrosive agent, the dead load should be increased by twenty-five per cent.

CONCENTRATED LOADS.

Concentrated loads and load due to crane girders shall be included in the consideration of dead loads.

PERMISSIBLE LOADS AND STRESSES.

All permissible unit loads and stresses should conform with local building by-laws.

See "Foundation Specifications for Bearing Power Soils."

Maximum Load per Square Inch on Different Kinds of Masonry from Bearing Plates.

For Granite, 800 lbs. per square inch.

For Best Grade of Sandstone, 600 lbs. per square inch.

For Soft Sandstone, 400 lbs. per square inch.

For Hard Stone Rubble, 150 to 250 lbs. per square inch.

For Extra Hard Brickwork in Cement Mortar, 150 to 200 lbs. per square inch.

For Common Brickwork, 150 lbs. per square inch.

For Good Portland Cement Concrete, 200 to 250 lbs. per square inch.

For Sand or Gravel, 60 lbs. per square inch.

STRESSES IN MASONRY.

Stresses in masonry shall not exceed the following:—

Concrete, 1-2-4 mix, 420 pounds per square inch.

Concrete, 1-3-5 mix, 280 pounds per square inch.

Good granite masonry, 420 pounds per square inch.

Good masonry, crystalline sandstone, limestone, 350 pounds per square inch.

Rubble masonry brick cement mortar, 140 pounds per square inch.

Hard burned brick, cement mortar, 210 pounds per square inch.

Stock brick cement mortar, 165 pounds per square inch.

LOADS ON TIMBER PILING.

The maximum load carried by a pile shall not exceed 40,000 pounds, or 600 pounds per square inch of its average cross section. The allowable loads on piles driven with a drop

hammer shall be found by means of the formula:

$$P = \frac{2W \times h}{s + I} \text{ where}$$

P = safe load in tons on pile.

W = weight of hammer in tons.

h = free fall of hammer in feet.

s = average penetration in inches for last six blows.

For a steam hammer use:

$$P = \frac{2W \times h}{s + 1/10}$$

Piles must be driven not less than 10 feet in hard material such as gravel, and not less than 15 feet in loam or soft material.

PURLINS.

Purlins shall be designed to carry the actual weight of roofing material, etc., but shall always be sufficient to carry a normal load of not less than 30 pounds per square foot.

GIRTS.

Girts are to be designed for a normal load of not less than 26 pounds per square foot.

ROOFING.

The roofing shall be designed to carry a normal load of not less than 30 pounds per square foot.

MINIMUM ROOF LOAD.

No roof shall be designed for an equivalent load of less than 30 pounds per square foot of horizontal projection.

ALLOWABLE STRESSES.

Specify the maximum allowable unit stress resulting from any given load or combination of dead, snow, wind or live or concentrated loads.

The following may be taken as allowable unit stresses for steel in tension, resulting from direct dead, snow and wind loads:—

Member.	Pds. per sq. in.
Main members, net section of rolled shapes.....	16,000
Bars.....	16,000
Laterals, net section, rolled.....	20,000
Steel Rods, Laterals.....	20,000
Web or Plate Girders, shear or net section.....	10,000
Rolled Shapes, subject to sudden loading or shock.....	10,000
Expansion Rollers, per lineal inch: where D = diam. in inches, 600 x D.	

Laterals are to be designed for a maximum stress due to 5,000 pounds initial tension plus maximum wind stress.

The allowable unit compressive stress for rolled shapes, for dead, snow and wind loads:

$$S = 16,000 - 70 \frac{l}{r}$$

Where S = allowable unit stress, pounds per square inch.

l = length of member in inches, c. to c. of end connections.

r = least radius of gyration of section in inches.

COMPOUND STRESS.

Where members are subjected to direct and bending stresses they shall be designed by use of the following formula:—

$$f = \frac{M y}{I} + \frac{P}{A}$$

— 10 E

f = unit stress in outside fibre, pounds per square inch.

M = bending moment in inch pounds.

y = distance from neutral axis to outside fibre in inches.

I = moment of inertia of the section.

P = direct load in pounds.

l = length of member, or distance from point of zero moment to end of member, in inches.

E = modulus of elasticity = 30,000,000.

A = area of cross section in square inches.

Add 50 per cent. to allowable stresses, as above, when combined bending and direct stress due to wind is considered.

STRESS DUE TO WEIGHT OF MEMBER.

Where the stress due to the weight of the member, or due to an eccentric load, exceeds the allowable stress for direct loads by more than 10 per cent., the section shall be increased until the total stress does not exceed the above allowable stress for direct loads by more than 10 per cent.

The eccentric stress caused by connecting angles by one leg when used as ties or struts shall be calculated, or only one leg shall be considered as effective.

PLATE GIRDERS.

Assume one-eighth of gross web area to be available as flange, and all shear to be resisted by the web only. Take the distance between the centres of gravity of the flanges as the effective depth of the girder.

Compression flanges shall have a section area at least equal to tension flanges, and must not be stressed more than 16,000—150— $\frac{l}{b}$ per square inch of gross area, where l = unsupported length and b = width of flange.

Compression flanges of plate girders must be stayed transversely when their length is more than thirty times their width.

Webs of plate girders must have stiffeners at ends and inner edges of bearing plates, and at point of application of concentrated loads, and also at intermediate points where the thickness of the web is less than one-sixtieth (1-60) of the unsupported distance between flange angles; not further apart than the depth of the full web plate with a maximum limit of five (5) feet. Stiffeners shall be designed as columns of a length equal to one-half the depth of the girder. Stiffener angles must have enough rivets to properly transmit the shear.

ROLLED SHAPES.

Rolled shapes are to be proportioned by their moments of inertia. Rolled beams for floors shall not be less than 1-20 of the span in depth. Rolled beams or channels used as roof purlins shall have a depth of not less than 1-40 of the span.

RIVETS AND PINS.

Rivets shall be so spaced that shear shall not exceed 11,000 pounds per square inch, and the pressure on bearing surface of the rivet holes (diameter x thickness of plate) shall not exceed 22,000 pounds per square inch. Rivets in lateral connections may have stresses twenty-five per cent. in excess of the above. Field rivets shall be spaced for stresses equal to two-thirds of those allowed for shop rivets. Field bolts when allowed should be spaced for stresses equal to two-thirds of those allowed on field rivets. Rivets and field bolts must not be used in direct tension. Connections in tension must be made with machine bolts.

Pins shall be such that shearing shall not exceed 11,000 pounds per square inch, nor pressure on bearing surface of the pin hole exceed 20,000 pounds per square inch. The maximum allowable fibre stress, in bending, in pins, shall not exceed 24,000 pounds per square inch when forces are assumed to be acting at the centre of the members.

ALLOWABLE WORKING UNIT STRESSES, in pds. per sq. in.

KIND OF TIMBER	Transverse Loading	End Bearing	Columns under Diameters C	Bearing Across Fibre	SHEAR		Modules of Elasticity E
					Parallel to Grain	Longitudinal Shear in Beams	
White Oak	1,200	1,200	1,000	450	200	110	1,150,000
Long Leaf Pine	1,300	1,300	1,000	300	180	120	1,610,000
White Pine and Spruce	1,000	1,000	800	200	100	70	1,130,000
Hemlock	1,000	1,000	800	200	160	100	1,480,000
Douglas Fir	1,200	1,200	1,000	350	180	110	1,510,000

TIMBER.

The following table gives values of allowable unit stresses in timber. Columns may be used with a length not exceeding 45 times the least dimension. The unit stress for lengths of more than 10 times the least dimension shall be those given reduced by the following formula:—

$$P = C \frac{Cl}{100d} \text{ where}$$

C = unit stress, as given for short columns.

P = allowable unit stress in pounds per square inch.

l = length of column in inches.

d = least side dimensions in inches.

CONSTRUCTION DETAILS.**Pitch of Rivets.**

The pitch of the rivets shall not exceed 6 inches, or sixteen times the thickness of the thinnest outside plate in the line of stress, nor forty times the thickness of the thinnest outside plate at right angles to the line of stress. The pitch must never be less than three times the rivet diameter. At the ends of compression members the pitch shall not be greater than four times the rivet diameter for a length equal to twice the width of the member.

Edge Distance.

The minimum distance from the centre of any rivet hole to a sheared edge shall be $1\frac{1}{2}$ inch for $\frac{7}{8}$ inch rivets, $1\frac{3}{4}$ inch for $\frac{3}{4}$ inch rivets, $1\frac{1}{8}$ inch for $\frac{5}{8}$ inch rivets and 1 inch for $\frac{1}{2}$ inch rivets.

From rolled edges the minimum allowable distance to centre of rivet hole will be $1\frac{1}{4}$ inch, $1\frac{1}{8}$ inch, 1 inch and $\frac{7}{8}$ inch respectively. The maximum distance from an edge to centre of hole shall be eight times the thickness of the plate.

Rivets' Diameter.

The diameter of rivets shall not exceed one-fourth of the width of the leg in which they are driven, but $\frac{5}{8}$ inch rivets may be used in 2 inch angles. The effective diameter of a driven rivet will be assumed the same as its diameter before driving.

All connections must have sufficient strength to develop the full strength of the member. No connections, except lacing, shall have less than two rivets. Field connections, except lacings, must have at least 3 rivets.

Sections.

In deducting the rivet holes to obtain net sections in tension members, the diameter of rivet holes will be taken as $\frac{1}{4}$ inch larger than the diameter of the undriven rivet.

No metal less than $\frac{1}{4}$ inch in thickness shall be used, except as fillers. No angles less than 2 inch x 2 inch x $\frac{1}{4}$ inch will be allowed. In special cases where heavy machinery, such as conveyors, breakers, etc., are installed, the minimum thickness should be increased.

Girder Details.

Flange plates of all girders shall not extend more than 6 inches, nor more than eight times the thickness of the thinnest plate beyond the outside line of rivets connecting them to the angles. Web stiffeners must be in pairs, end stiffeners to have fillers, intermediate stiffeners to have fillers or be crimped over the flange angles. The rivets in stiffeners must not be pitched more than five inches apart.

Web plates shall be spliced by a plate on each side of the web capable of transmitting the shearing and bending stresses at the section through the splice rivets. Splices may be made by plates crimped over the flange angles or with fillers.

Tension Pin Connections.

Pin connected riveted tension members shall have a net section through the pin hole of twenty-five per cent. in excess of the required net section of the member. The net section back of the pin hole through the centre line of the pin shall be equal to at least three-quarters of the net section through the pin hole.

Columns.

Columns which take flexure shall preferably consist of four angles laced, or four angles and a plate. Side posts not subject to flexure, but under heavy loading, shall preferably consist of two channels laced, or of two channels and a centre diaphragm. Posts in end framing shall preferably be I-beams or four-angle columns laced. Corner columns, where possible, to consist of one angle. The cross bending stress due to eccentric loading in columns carrying crane runways, should be calculated. Where the cranes have high capacity the crane girders should be carried on independent columns.

Trusses.

Upper chords of trusses shall have symmetrical cross section, and shall consist preferably of two angles, back to back. All compression members for roof trusses, except sub-struts, shall consist of sections symmetrically placed. Sub-struts may be single sections. Trusses shall be spaced, where possible, so as to avoid the use of trussed purlins. Single sections shall always be used as purlins where possible. Purlins and girts shall be preferably channels, angles or Z bars, with web at right angles to the truss. They shall be fastened to the top chord of trusses and to columns by means of angle clips with two rivets in each leg. Purlins for corrugated steel, when no sheathing is used, shall be spaced so as not to exceed the safe span for the corrugated steel used, when 30 pounds per square foot is taken as the roof load. Space girts for a safe load of 25 pounds per square foot.

Tension Members.

Tension members shall preferably consist of angles or shape capable of acting in compression as well as tension. Flats riveted at ends

must not be used. Main tension members may be two angles, two angles and a plate or two channels and lattice. Secondary tension members may be a single shape. All rods with screwed ends, except sag rods, must be upset so that diameter at bottom of thread shall be 1-16 inch greater than diameter of rod. The length of main tension members in which stress is reversed by wind shall not be more than one hundred and fifty times their least radius of gyration in length. Riveted tension members in horizontal or inclined position shall have a length not exceeding 200 times their least radius of gyration, except wind braces, which may have a length equal to 250 times least radius of gyration. Take the horizontal projection of the unsupported length of inclined members as the effective length.

PAINTING.

All steel work before shipping should be cleaned of all scale and rust and given good coat(s) of paint well worked into all joints.

Riveted work must have parts in contact painted before the riveting is done. Parts not accessible for painting after erection should have three coats of paint.

STEEL.

Steel may be made by either the open-hearth or Bessemer process.

All tests and inspections shall be made at the place of manufacture prior to shipment.

The tensile strength, limit of elasticity and ductility, shall be determined from a standard test piece cut from the finished material.

On tests or other material the test piece may be either the same as for rolled shapes, or it may be planed or turned parallel throughout its entire length; but, in all cases, where possible, two opposite sides of the test piece shall be rolled surfaces. The elongation shall be measured on an original length of 8 inches except as modified later. Rivet rounds and small bars shall be tested of full size as rolled.

Two test pieces shall be taken from each melt, or blow, of finished material, one for tension and one for bending; but in case either test develops flaws, or the tensile test piece breaks outside of the middle third of its gauged length, it may be discarded and another test piece substituted therefor.

Material which is to be used without annealing or further treatment shall be tested in the

condition in which it comes from the rolls. When material is to be annealed or otherwise treated before use, the test piece shall be similarly treated before testing.

Every finished piece of steel shall be stamped with the blow or melt number, and steel for pins shall have the blow or melt number stamped on the ends. Rivet and lacing steel, and small pieces for pin plates and stiffeners, may be shipped in bundles securely held together, with the blow or melt number on attached tag.

Finished bars shall be free from injurious seams, flaws or cracks, and have a workman-like finish.

Maximum percentage of phosphorus permissible in steel for buildings, train sheds, highway bridges and similar structures is 10 per cent.

Ultimate strength of rivet steel, 48,000 to 58,000 pounds per square inch.

Elastic limit, not less than one-half the ultimate strength.

Percentage of elongation, 1,400,000 divided by ultimate strength.

Ultimate strength of medium steel, 60,000 to 70,000 pounds per square inch.

Percentage of elongation, 1,400,000 divided by ultimate strength.

Bending test, 180 degrees to a diameter equal to thickness of piece tested, without fracture on outside of bent portion.

For material less than 5/16 inch and more than 3/4 inch in thickness, the following modifications shall be made in the requirements for elongation:—

For each increase of 1/8 inch in thickness above 3/4 inch, a deduction of 1 per cent. shall be made from the specified elongation, except that the minimum elongation shall be 20 per cent. for eye-bar material, and 18 per cent. for other structural material.

For each increase of 1-16 inch in thickness below 5-16 inch a reduction of 2 1/2 per cent. shall be made from the specified elongation.

In rounds of 5/8 inch or less in diameter, the elongation shall be measured in a length equal to eight times the diameter of section tested.

For pins, the required elongation shall be 5 per cent. less than that specified for each steel mentioned as determined on a test piece the centre of which shall be one inch from the surface of the bar.

A variation in cross-section or weight of more than two per cent. from that specified will be sufficient cause for rejection.

Architectural Engineering by Joseph Kendal Freitag. Jno. Wiley & Sons, New York.

Architectural Iron and Steel. Jno. Wiley & Sons, New York.

Cambria Steel, Pub. by Cambria Iron Company.

Carnegie Steel Pocket Companion. Pub. by Carnegie Steel Company, Pittsburg.

Civil Engineers' Pocket Book, Jno. C. Trautwine. Jno. Wiley & Company, New York.

Skeleton Construction in Buildings. Jno. Wiley & Sons, New York.

MILLER BROS. & SONS, LIMITED

MACHINISTS - MILLWRIGHTS - ENGINEERS

MONTREAL, - CANADA



Product Every kind of Machine and Millwright Work. Engineers and Contractors for complete factory transmission equipment. Agents for the "Bond Double Sure" transmission machinery. We carry in stock a complete line of shafting, hangers, pillow blocks, "Spiro" and flange couplings.

Write for Catalogue and Prices.

The "Bond Double Sure" This is the "Bond Double Sure" patent shaft hanger. There are hangers—and hangers, but only one real hanger—It's the "Bond Double Sure."

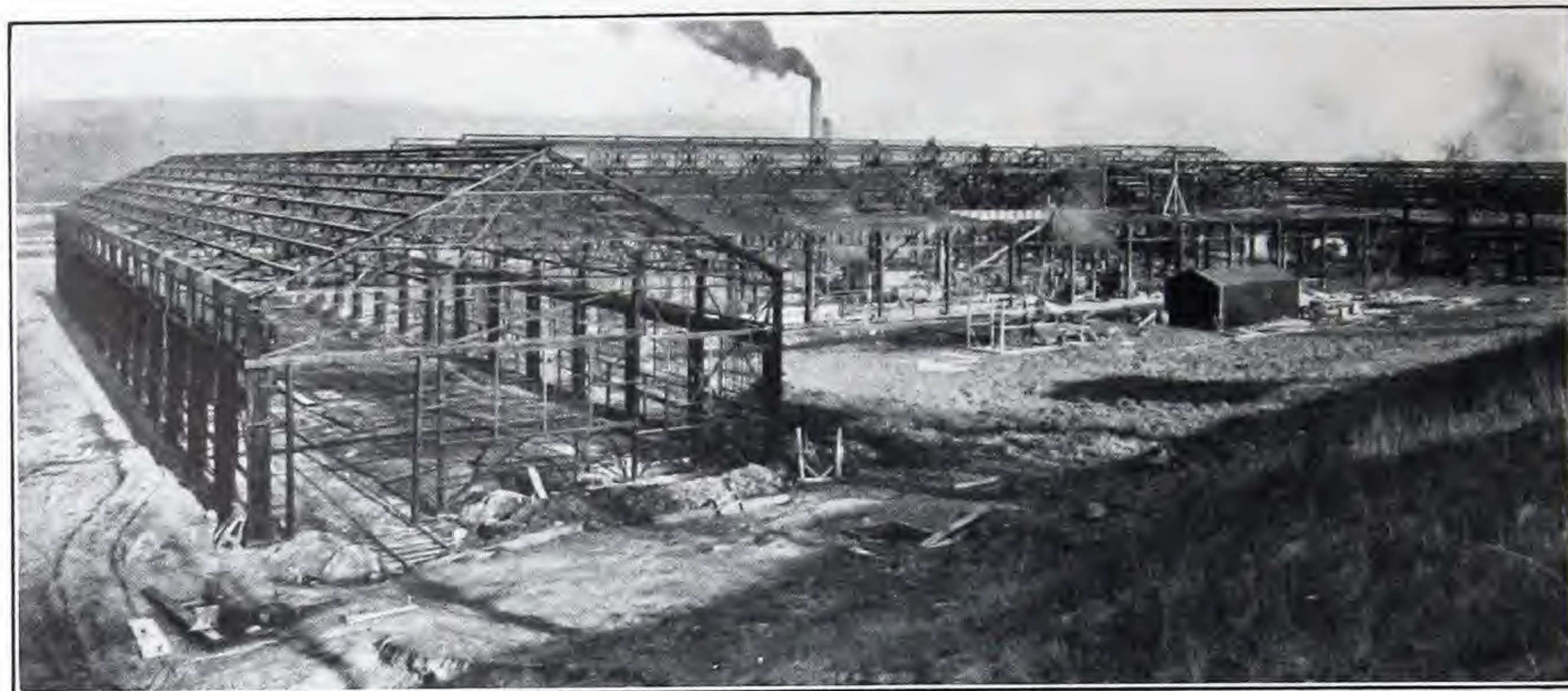


This is the "Bond Double Sure" patent "Spiro" shaft coupling, and like the Bond shaft hanger is in a class by itself.

"I'll make assurance double sure and take a bond."—Shakespeare.

STRUCTURAL STEEL COMPANY, LIMITED

MONTREAL



New Plant of Canadian Rolling Mills Co. Limited, Montreal
Steelwork designed, fabricated and erected by Structural Steel Co. Limited.

- | | |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Product | Structural Steel for Every Purpose. |
| Service | Steel Buildings of every description furnished and erected. |
| Stock | We carry in stock 8,000 tons of structural shapes and plates and are always in a position to make prompt shipments of plain or fabricated material. |
| Capacity | 18,000 tons annually. |
| Correspondence | We will gladly furnish estimates or information on structural steel. |

NOTES ON GREENHOUSE CONSTRUCTION

GENERAL.

The floor of the greenhouse should be kept a few inches above the outside grade. Much is added to the appearance if the house is placed on a slight terrace. Keep the floor all on one level and start at the highest point of a grade when such exists.

All sod and loam should be removed from the site and the filling necessary made with subsoil, laid in thin layers, wet and thoroughly tamped. Loam filling under a greenhouse is likely to become sour and will continue to settle for a long time.

Foundation walls should be of brick, stone or concrete, and should extend below the frost line and usually are carried two feet or so above the grade. Rubble stone below ground or concrete is quite satisfactory. Any construction may be used above ground, but in commercial greenhouses the wall is often on cast iron posts and consists of double boarding with a removable base.

When all wood framing is adopted for small houses it is considered the best practice to use small purlins supported on pipe columns, or where light is not the largest consideration, use small rafters from 5 to 8 feet c. to c. with cast iron brackets at ridge and plate. These rafters are connected by light angles, as purlins, which support light sash bars. The ridge is carried on gas-pipe posts, and when rafters have long span, similar posts are placed at their centres.

Cypress is by all means the best wood to use for greenhouse construction, as there is perhaps no other wood which will so well resist dampness, excessive heat and decay. Framing should be one-piece as far as possible, and heart wood swamp cypress if obtainable. Walks, benches and bases, etc., where appearance is not a consideration, may be made from "pecky" cypress, which has lasting qualities equal to the sound wood. It is not used in any portion of the greenhouse superstructure.

It is very essential that all cypress used in greenhouses be air dried, i.e., it should be piled for two years before being cut, and then if not thoroughly dry should be left in the piles until it is dried. Kiln dried cypress is worthless for this work.

In combined iron and wood construction the main framing which supports the roof is of structural steel, wood being used in the frames for the setting of the glass, and as a non-conductor of heat. Cast iron sills, one-piece sills and gutters, and cast iron gutters, and framing brackets, are usually used to complete the structure with a minimum of field work. Wooden sash bars, sashes and doors, supported on the iron framing, are found to be as durable as any other material.

By exposing the inner side of cast iron gutters to the air in the greenhouse, sufficient heat is carried to the gutter to prevent accumulation of snow and ice. In wooden framing decay first starts where joints are made; in order to avoid decay where wood and iron are combined, all joints should be metal to metal or metal to wood. It is found that joints between metal and wood do not rot, as the iron oxide acts as a preservative.

An iron frame house, besides being cheaper than a wood house, is very much lighter, as all the members are very much reduced in size.

GLAZING.

Glass for greenhouses should be obtained from makers who handle special lines for this purpose. A heavy glass, not necessarily of highest quality as window glass, should be selected. "Lenses" which concentrate the sun's rays and burn the plants are found in nearly all glass. Makers who sell special greenhouse glass select it to avoid such as far as possible. The selection is made by actual testing in sunshine or by means of micrometer calipers; bubbles, blisters, etc., are seldom the cause of burning, which is due to imperceptible differences in the thickness of the pane. Plate glass makes a handsome and satisfactory roof, but the cost is considerably higher than for ordinary window glass. Glass should be bedded in good putty on wood sash and lapped from $\frac{1}{8}$ to $\frac{1}{4}$ inch. It should fit the rabbets within 1-16 inch. Where panes are butted, or very long, grooves should be provided in the sash bars to carry off condensation.

PAINTING.

All wood should receive a priming coat, largely of oil, before making joints, or before being exposed to the weather. Metal should be painted, 3 coats with any good metal paint. Wood to get 3 coats, of good white lead and oil paint, at least.

VENTILATION.

In long greenhouses the ventilating sash should be in three or four sets, and not all operating by one mechanism. Ventilators should average about one-tenth of the roof area and be on both sides of the ridge, to allow the ventilators to be opened on the lee side of the greenhouse.

HEATING IN GREENHOUSES.

The problems of heating in greenhouse work are essentially different from those met with in ordinary construction. This is due to the

very large proportion of exposed glass compared to the wall area and the cubical contents of the building. Also, where hot water is used, the available head is very small, and to further alter the conditions which usually prevail, the radiation used is usually coils of 2 to 3½-inch pipe. Some engineers consider the case so special that the ordinary theoretical formulae are inapplicable, and hence there have been many empirical formulae put forth for use in this connection. Whatever other merits these may have, they do not give the assurance of a rational formula, but may be useful as a check. Experience in this class of work will enable the user to decide upon his methods.

Heat losses may be determined by means of the well-known Carpenter formula:—

$$L = (G + .25 W + .02 n Q) t.$$

Where

L = B.t.u. lost per hour.

G = Exposed glass area in square feet.

W = Exposed wall area in square feet.

n = A factor which varies according to the number of air changes per hour required; and should not be less than 3.

Q = Cubical content.

t = Difference between inside and outside temperature.

For double glass and special wall construction G and W should be multiplied by the proper co-efficients and not by 1 and ¼ as in the above formula.

B.t.u. transmitted per hour per square foot of surface for:

Single window per degree difference of temperature = 1.09, double window = .46, single skylight = 1.16, double skylight = .48.

When a satisfactory value has been obtained for the heat loss, L, the amount of radiating surface can be found by,

$$R_1 = \frac{L}{2.1 (170 - t_1)} \text{ or } R_2 = \frac{L}{2.1 (220 - t_1)}$$

Where

R₁ = sq. ft. of hot water radiation.

R₂ = sq. ft. of steam radiation.

t₁ = inside or room temp. in degrees Fahr.

There is a radiation of about 2.1 B.t.u. per square foot per hour per degree difference of temperature from ordinary W.I. pipe in air. This means that in hot water coils 210 B.t.u. per hour per square foot will be transmitted, and 315 B.t.u. per hour per square foot for low pressure steam heating, and inside temperature of 70 degrees Fahr.

For an inside temperature of 70 degrees Fahr., the formulae becomes:

$$R_1 = \frac{L}{210} \text{ and } R_2 = \frac{L}{315}$$

Some engineers regard the heat loss by convection as negligible. On this assumption we get,

$$R_1 = \frac{(G + .25W) 70}{210} \text{ and } R_2 = \frac{(G + .25W) 70}{315}$$

in zero weather. Or by considering the glass alone a further simplification follows which gives a common rule, namely, **one square foot of hot water radiation to three square feet of glass, and one square foot of steam radiation to five square feet of glass.** In private greenhouses hot water heating is much more common than any other system, and greenhouse engineers with very long experiences use simply the above ratio of 1 to 3 to give a temperature of 55 to 60 degrees in zero weather.

Dean's System of Greenhouse Heating. The Domestic Engineering Co., Chicago.

LORD & BURNHAM CO. LIMITED OF CANADA

Greenhouse Designers and Builders

12 Queen Street East - - - - Toronto

NEW YORK, N.Y.:
42nd Street Bldg.

BOSTON, Mass.:
Tremont Bldg.

PHILADELPHIA, Pa.:
Franklin Bank Bldg.

CHICAGO, Ill.:
Rookery Bldg.

ROCHESTER, N.Y.:
Granite Bldg.

CLEVELAND, Ohio:
Swetland Bldg.

Product Sectional Iron-Frame Greenhouses and Conservatories.

**Con-
struction** Our Sectional Iron-Frame Greenhouse has been developed and perfected through our constant efforts to secure greater durability, and to meet the demand of gardeners for more light.

One section is formed by setting up two spans of rafters, 8 feet 4 inches apart, at either end of two lengths of cast-iron sills. The cross framing between these two spans of rafters consists of the gutters at the eaves and purlins between the eaves and ridge. These latter are placed the right distance apart to carry the roof bars. Another section may be added by setting up one more span of rafters 8 feet 4 inches further along, with cross framing, and so on until you have the required number of sections for the length of the house.

Materials All iron is of the highest grade; the wood used is clear Gulf Cypress of best quality, thoroughly air-dried. This wood grows in the swamps of Florida, and has proven to have no equal for withstanding the destructive conditions of constant moisture existing in greenhouses.

Glazing All glass is bedded in putty and supported by wooden parts, which prevent breakage by expansion and contraction.



Exterior Warberg.

Continued on next page

LORD & BURNHAM CO. LIMITED OF CANADA**12 Queen Street East - - Toronto**

Repairing Aside from the usual repainting, the matter of repairs is a minor one, for the small roof bars are fastened with iron clasps, and it is a simple matter to unscrew them, cut out the defective part and splice in a new piece.

Erection This is the ideal greenhouse construction, so scientifically worked out that the labor of preparing materials and erecting is reduced to a minimum. It is not a house that has to be cut and fitted by hand on the job, but the entire frame is passed through a line of machines in our factory, where it is cut, shaped, punched, fitted and primed, ready for immediate erection. When the materials are delivered it is merely a matter of bolting up the iron parts and fastening the screws. The expense of erecting is thus greatly reduced, practically equalizing the advance in cost of the iron-frame house over the wooden structure.

Ventilation Ventilating sashes are located at ridge and where required on the sides. They are in continuous runs and are opened by our patented Ventilating Machinery, with hand wheel placed in convenient location.

Heating Coils of $3\frac{1}{2}$ inch (I.D.) cast-iron pipe, made up with caulked joints, are generally located under the benches where they do not take up any growing space, and are so arranged as to secure a free circulation of air around them. Their surfaces are so distributed as to give the desired temperature with sufficient control in each compartment to produce the best growing conditions.

"Burnham" Boilers are used with ample mains for carrying water to the coils.

The system is installed with sufficient grade to insure rapid circulation and even distribution. The coils are equipped with automatic air-headers to prevent all air locks.

Catalog We have a very complete Catalog to which you are most welcome.



PARKES CONSTRUCTION COMPANY

Horticultural Engineers
Landscape Architects and Contractors

HAMILTON - - - ONTARIO

Product We design, construct and install Greenhouses in three types. The All-Wood Greenhouse—The Pipe Frame House—and Steel Frame House.

All Wood Greenhouse This type is constructed rarely more than 15 ft. wide with 3 ft. walls. It is made of sash bars of proper dimensions, is furnished with a wood eave plate or wood gutter supported on wood or iron columns, and connected with a cast iron cap securely bolted in position. All wood members are true to section and are grooved to carry off the condensation.

The Pipe Frame Greenhouse This type is an improvement on the all wood type, having more light on account of the lighter sash bar used. The columns or post supports that carry the roof-load are arranged under each purlin, the spacing of these being about 8 ft. 4 in. apart lengthwise of the house. These are connected to the purlin by the use of strong cast iron clamp fittings. Posts can be eliminated to a certain extent by the use of Y-Braces or Cross braces according to conditions.

The Steel Frame Greenhouse Made and designed on structural lines has received the endorsement of expert engineers. It is made of all Structural Shapes and is put together in a most practical and scientific manner. The number of fittings is reduced to a minimum which makes this type of house very easy to erect. It is a tower of strength under the most trying conditions.

Other Products Palm Houses, Sun Parlors, Pergolas, Ventilating Apparatus, Benches, Greenhouse Hardware, Hot Bed Sash and Frames, Heating Material, Ornamental Iron Work.
Fireproof Boiler Houses, Farm Buildings, Service Buildings, Light Steel Structures, etc.

Any information gladly forwarded on request.

PIERSON U-BAR COMPANY

BUILDERS OF U-BAR GREENHOUSES

10 Phillips Place, Montreal

1 Madison Ave., New York

Products We manufacture, erect and equip U-Bar Greenhouses. Equipments consist of Ventilating Apparatus, Benches, Tables, Complete Heating Plant, etc.



Description In the U-Bar construction we encase the wooden roof glazing bar with a galvanized steel U-shaped Bar, the combined members being no larger than the smallest wooden roof-bar used in other forms of constructions.

Owing to their strength we are enabled to eliminate all the heavy iron rafters and many lateral supports, and to place the bars farther apart, permitting the use of glass twenty-four inches wide, which eliminates heavy shading members assuring unusual productiveness. By bending the bar at the eave line and using curved glass at this point we eliminate all cumbersome gutters, plates, posts, and other shading members, resulting in a structure of extreme lightness and of great strength.

Advantages The steel covering of the wooden bar eliminates interior woodwork with its tendency to decay. The galvanizing of all steel members prevents rusting; the use of the wooden core-bar prevents injurious expansion and contraction of the structure and consequent glass breakage. All these features combine to produce a structure of wonderful durability and low cost of maintenance.

Core-Bar It is Red Gulf Cypress, free from sap and knots, and is milled from thoroughly air-dried stock. All curved portions are cut from the solid block to prevent warping out of shape.

U-Bar It encases the lower part of the cypress core-bar, the latter being screwed up to the U-Bar with screws placed alternately on either side at frequent intervals, thus securing the binding of the core-bar and U-Bar together.



Continued on next page

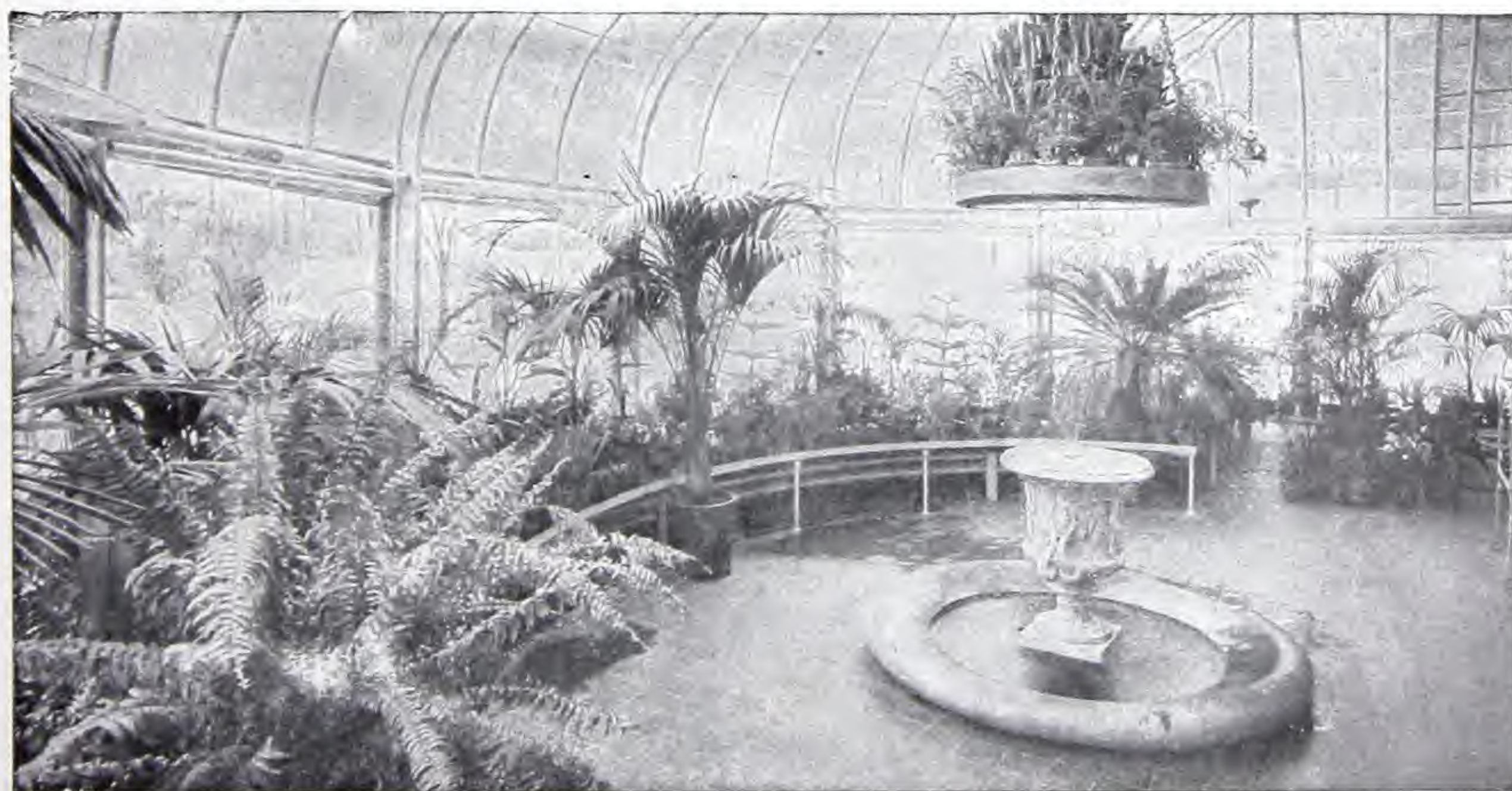
PIERSON U-BAR COMPANY

Snow-free Roof There being no gutter at the eave to hold back the snow or collect ice, the roof frees itself of snow.

Catalog Our catalog contains many exterior and interior views of erected houses and blue print sections of standard dimensions. It is arranged in a way to be particularly valuable to the architect.



We took this photo as a most convincing bit of evidence of the superior lightness and attractiveness of U-Bar Greenhouse Interiors.



Interior of U-Bar Conservatory erected for Mortimer B. Davis, Montreal, Canada

TYPICAL SPECIFICATIONS OF REFRIGERATING MACHINERY AND INSULATION

The following specification may be taken as typical of the specification an architect would be called upon to write to secure an installation of refrigerating machinery and the necessary insulation.

The steam-driven ammonia plant was not chosen for any particular reason, except that this type of plant is common. The specification is not intended in any way as a guide to be followed in selecting the machinery or kind of insulation, and the arrangement here given is not recommended as either good or bad engineering practice. In other words, no attempt has been made to specify "the best," but merely to present the usual form in which the architect specifies his requirements to the manufacturers of this class of machinery.

STEAM ENGINE.

One improved inch x inch horizontal Corliss type engine, having cylinder of semi-steel, complete with throttle valve, steam and exhaust valves, indicator connections, lagging, planished steel cover. Engine to have heavy rigid frame and pillow block with quarter boxes with liner of best grade babbitt metal hammered in, bored and scraped to fit shaft, connecting rod to be of solid forging with heads slotted out from a single piece, the cross head end fitted with hard brass, the big end with boxes and with best grade babbitt metal. Automatic release valve gear to be fitted with wearing surfaces of hardened steel removable plates with dash pots of noiseless type, governor driven by double belt from main shaft, and provided with safety stop and speed regulator. The engine is to be of such size as to efficiently drive the compressor specified when supplied with steam at 100 pounds pressure, and quality at least 98 p.c., exhausting through feed-water-heater to atmosphere, when running at 75 R.P.M., and with an ample supply of cooling water passing over the ammonia condenser at a temperature of 65 degrees Fahr.

AMMONIA COMPRESSORS.

A horizontal double acting ammonia compressor, with double suctions, not less than inch x inch stroke, to run at revs., usual delivery connections, check valve, oil collector, rectifier and other usual parts. Compressor is to have long stuffing box fitted with lantern, so as to carry double packing, also gland with oil seal and a super screwed gland provided with proper packing; the main gland is to be fitted with a sight feed lubricator of ample size. Although not insisted upon, it is preferred that the compressor should be fitted with removable liner of special hard close grained cast-iron, so housed as to form a water jacket. Both front and back covers shall be arranged so that the valves and cages may be removed without disturbing any

pipe connections. Also the pressure ammonia gauges with valves shall be fitted with not less than inch diameter dials with pressures marked in black and temperatures in red. All valves in compressor covers are to be of ample size, with suitable springs, and the suction valves are to be fitted with safety collars turned out of the solid. All valves to be of high quality mild steel, and all cages are to be interchangeable. Compressors to be fitted with pump over connections. The machine is to have a large heavy fly-wheel turned on face for belt, and to have hand gear for barring round, of safety type. Ammonia cylinders to be fitted with suitable valves for taking indicator cards.

AMMONIA CONDENSER.

Of the open air type, consisting of vertical sheets of 2 inch extra heavy lap welded galvanized iron pipe. Coils to be strapped and stayed to suitable uprights with gas and liquid headers and purging connections.

Coils are to be carried in a tank not less than inches deep, constructed of $\frac{1}{4}$ in mild steel plate, fitted with angle iron curbing, with combined overflow and drain connection.

Tanks to be tested, and, after being found watertight, to be painted with good preservative paint.

LIQUID RECEIVER.

A liquid receiver of ample size to be connected to the ammonia condenser, and is to be placed alongside the condenser tank over the engine room roof.

AIR COOLER.

A battery air cooler capable of handling satisfactorily cubic feet of well insulated space at degrees Fahr. for the storage of eggs. (It is to be noted that later on it is proposed to add to the above two more chambers, which will also be used for egg storage). Provision is to be made that the air cooler shall be capable of handling this work, and the fan and brine pump are to be such that the speeds can be increased later on to suit full requirements.

The air cooler is to be constructed of not less than four vertical sheets of $1\frac{1}{4}$ inch lap welded continuous coils coupled up to suitable liquid distributors and gas collectors.

Each sheet or tier is to be provided with stop cocks at each end, so that any one tier may be laid off if required. These coils are to be tested to at least 2,000 pounds per square inch hydraulic pressure, and are to be strapped and stayed to suitable uprights and coated one coat of good quality preservative paint.

FAN.

Fan not less than inch diameter, of the low pressure propeller type, of suitable size for circulating full quantity of air through a total loss of cubic feet of storage at degrees Fahr., based upon a rise of not more than degrees Fahr. This fan is to do the work when running at a speed not exceeding R.P.M. Fan to be equipped with self-oiling bearings.

BRINE PUMP.

Brass fitted centrifugal brine pump with suction connections to tank and delivery connection to headers.

SHAFTING.

Countershafting with pulleys, belts and striking gear is to be fitted for driving the fan and brine pump, with suitable fast and loose pulleys, with striking gear for receiving the drive from motor.

DIRECT EXPANSION PIPE.

The contractor is to supply and erect 2 inch heavy wrought iron lap welded piping in flanged lengths of about 16 feet, to maintain temperatures for butter and meat storage in insulated chambers.

These pipes are to be placed overhead with a sufficient number of galvanized pipe hangers and bearing bars of substantial make. All flanges in this piping are to be square, male and female type, with four bolts each and pure lead gaskets. Piping is to be run in suitable systems or circular fitted with liquid and suction control valves. Contractor is to specify in detail, the amount and weight of piping he proposes to supply for the rooms as specified.

AMMONIA CONNECTIONS.

The contractor is to include complete high pressure side connections, as well as suction connections to his air cooler, and in addition must cross connect the gas delivery and main liquid supply lines.

FIRST CHARGE.

First charge of anhydrous ammonia is to be supplied and the machine is to be left fully charged.

First charge of chloride of calcium is to be supplied and the plant left fully charged with brine at a temperature of 10 degrees Fahr., and at a density of 1.250 (water being unity).

A supply of compressor and machinery oils for six months' working is to be left on the job.

SPARE PARTS.

Contractor is to specify the spare parts he proposes to supply and include in his tender.

SUNDRIES.

One good thermometer screwed into suitable fitting in the brine delivery from pump to air cooler, two hanging thermometers for each of the cold rooms, one brine densimeter, complete set of spanners.

EXCLUSIONS.

Purchaser will supply the following work and parts:—Foundations for steam engine and compressor, brine pump, platform for ammonia condenser, water supply to and overflow pipes from the ammonia condenser, overflow connections from air cooler to drain, steam and exhaust connections to engine.

TEST.

Upon the complete erection of the machinery, the contractor is to run a six days' test, during which he shall supply all necessary skilled and unskilled labor, oil, waste and other material required, and the contract shall not be considered as completed until the termination of a satisfactory test of this kind.

GENERAL.

The contractor for insulation will leave suitable openings for the passage of pipes and connections through the insulation, provided requirements are given before his work is completed, and will make good such openings.

PLANS.

The contractor shall furnish plans giving the general arrangement of the various parts of the installation, the proposed run of the various pipes, etc., for approval, and shall not proceed with the work without the engineer's approval in writing.

LAGGING.

Contractor to give separate price for lagging, where necessary, the exposed brine and ammonia pipes and fittings with covering, not less than inches thick, properly fitted, cemented, wired, covered with canvas and painted (one) coat of waterproof or approved paint.

INSULATION

The best known and most efficient insulator is pure compressed cork, in the form of sheets.

There is a point at which, by increasing the thickness of insulation, the first cost can be raised so high that the extra gain in efficiency of the refrigerating plant is more than offset by the interest in the extra capital investment. In actual practice, however, such a point has not been reached; as a rule it is im-

agined that a refrigerating machine will produce the temperature easily enough, and that the insulation is a secondary consideration. The thickness of insulation which is advisable to specify depends upon the following points:—

1. Temperature required in the cold chamber.
2. Hours of working of the machine.

3. The nature of goods to be cooled.
4. The location of the rooms.
5. The site of the building.

As regards these, the point of temperature may, first of all, be approximated by the following, which is good practice. Temperatures of zero to 10 degrees below, not less than 6 inches pure sheet cork.

10 degrees to 15 degrees, 5 inches sheet cork.

15 degrees to 20 degrees, 4½ inches sheet cork.

20 degrees to 30 degrees, 4 inches sheet cork.

30 degrees to 35 degrees, 3 inches sheet cork.

35 degrees to 45 degrees, 2 inches sheet cork.

All these are based upon the insulation being backed up by substantial brick or stone walls, and by concrete floors and ceilings. It should be here understood that all materials are, more or less, non-conductors of heat, and therefore the brick wall has some insulating effect, this value depending upon the thickness of same.

Diagram No. _____ gives the insulating effect of brick walls of various thicknesses, and the loss is given in British thermal units per 24 hours for each square foot of wall surface per each degree difference in temperatures. The British thermal unit, which is the standard of heat measurement, is the amount of heat required to raise the temperature of one pound of water at 60 degrees Fahr., one degree.

Therefore, the loss of heat or cold simply means the total square feet of surface by the difference between the cold room temperature and the outside air temperature by the constant taken from the diagram will give the amount of thermal units lost per day. For very exact calculations it should be noted that the wall face temperatures are not identical with the air temperatures, but such requirements are too small for consideration in this case.

For greater convenience the diagram gives the increase of insulating effect when such a brick wall is insulated with pure compressed cork of various thickness, and the curves give graphic evidence of the gain made when insulation is so added.

As to point 2, the hours of work, many cases of disappointment have been caused by omitting this item. It cannot be too strongly impressed upon users of cold storage that all legends to the contrary notwithstanding, the only possible guarantee to steady, constant temperatures is to run at least some part of the refrigerating plant continuously day and night during hot spells. We here refer to cases calling for steady temperatures not to vary more than ½ degree Fahr. each side of the required reading.

The best insulation must leak, and the goods under treatment are very seldom chilled right through to the air temperature, and when the cooling effect is shut off it is a physical impossibility to prevent the rooms rising in temperature.

The greatest misunderstanding exists upon this matter, and a little consideration will show that natural laws absolutely prohibit such results.

In this connection, it is generally accepted that if a room holds a steady temperature during a shut-down of say 10 hours of the refrigeration, that such room is therefore proved to be efficiently insulated. This in no way follows as a fact, such a test proves the opposite, that the insulation is poor and defective.

When the insulation is poor, defective and old, it often happens that the room temperature will actually fall during a shut-down over night, and this, far from being remarkable, is the natural effect when the subject is understood.

However, cases exist, especially in cases of refrigerating plants of small capacity erected for small hotels and tradesmen's refrigerating boxes and small rooms, where it is impossible to run the plant continuously day and night. Here the plant is operated, say, five hours in the morning, and about four hours in the evening, with shut-down over night.

Here the brine circulation, with large storage drums or tanks, will help the insulation, and prevent a rise greater than a few degrees, which is not harmful, especially if before stopped the temperatures are forced a line or two below the regular average temperature. Other matters can be made to give material help also, for instance, have a thick heavy concrete floor, and make the inside lining of glazed brickwork.

BRICK WALL INSULATION.

The existing brick walls are to be cleared of all whitewash or paint, thoroughly brushed and insulated as follows:—

A course of cork sheets 2 inches thick by 36 inches long by 12 inches wide are to be run upon edge and properly set against wall with a bed of about half an inch Portland cement plaster, composed of one part of Portland cement to two parts of clean, sharp sand. All vertical joints in sheets are to break with the next course.

Against this to be set up a second layer of 2-inch cork, with ½-inch Portland cement plaster bed as before specified. All joints in second layer are to break joint in both horizontal and vertical way with the first layer of cork.

After this work is thoroughly set it is to be plastered as follows:—

A coat of approximately ¼-inch thickness of Portland cement plaster in parts of 1 to 2, rough scratched and left to dry. A second coat of P.C. plaster a full ¼-inch thick, composed of 1 part of Portland cement to 1½ parts of good sand, run flat and true and brought to a float finish and struck to panels 4 feet long by 2 feet deep with joints broken.

The face plaster coating shall be thoroughly damped with clean water for at least four days to prevent hair cracking.

CONCRETE FLOOR INSULATION.

The concrete flooring will be finished to a reasonably true and flat face, with necessary falls for drainage, by the building contractor.

Upon this shall be laid a course of cork 2 inches thick, set in a bed of $\frac{3}{8}$ -inch thickness of hot asphalt. The insulation contractor is to make the floor dry and clean, and shall, if necessary, heat the concrete face for a good job.

After this work is set, the cork shall be flooded with $\frac{3}{8}$ -inch of hot asphalt, and as run a second layer of 2-inch cork sheets shall be bedded, all joints breaking with first layer, all joints pressed tight and true, and, where necessary, held in position by 4-inch wood skewers driven on skew.

The exposed surface of cork sheets shall be flooded with about $\frac{1}{8}$ -inch of hot asphalt, and upon this the 3-inch concrete floor finish as specified later shall be laid.

CONCRETE FLOOR INSULATION.**Three-inch Floor.**

Concrete floor will be finished to a reasonably true and flat surface, with necessary falls for drainage, by the building contractor.

This floor shall be cleaned, dried and heated, if necessary, and flooded with hot asphalt.

Upon this shall be laid 3-inch x 3-inch spruce sleepers, at 39-inch centres. A layer of 3-inch cork sheets shall be tightly fitted between the sleepers with all joints tight and true.

The exposed surface of this work should then be flooded to a depth of at least $\frac{1}{8}$ -inch with hot asphalt.

Two layers of 3-ply waterproof paper of approved make shall then be laid, all joints lapping 3 inches, and sealed with hot asphalt. Upon this shall be laid one layer of 1 $\frac{1}{4}$ -inch tongued and grooved good, dry spruce flooring, securely nailed to the sleepers. Two layers of waterproof paper shall then be laid, with joints lapped at least 3 inches, and this shall be covered by the timber working floor, as specified later.

ASPHALT FLOOR FINISH.

The exposed cork floor shall be properly cleaned, any loose sheets being firmly secured. It shall then be brushed with a mixture of 1-2 Portland cement and sand, and thoroughly grouted in all joints, and care should be taken to fill the skirting joint. When this cement is thoroughly dried, $\frac{3}{4}$ -inch of best quality mastic asphalt flooring shall be laid in two $\frac{3}{8}$ -inch coats, each coat being carried up the side walls for at least 4 inches, and this skirting shall unite with the floor with a large fillet. The top of the asphalt skirting shall be struck back on angle to meet the $\frac{3}{8}$ -inch thickness of wall plaster.

Any drain, water, gas pipes, or other fittings passing through the floor shall be protected by cork thimbles, and the asphalt skirting shall be carried up at least 4 inches around such thimbles, in a similar manner to the skirting. Special care shall be taken to see that the asphalt is thoroughly bonded with

the door frames at the sill and sides, and such union shall be protected by galvanized iron sill plates, which shall cover and protect this joint.

INSULATION OF CONCRETE FLOORS.

The concrete floors yet to be formed will be insulated as follows:—

The forms fitted by the building contractor will be run 2 $\frac{1}{2}$ inches deeper than usually required, to provide for a layer of 2-inch cork board sheets, which will be laid upon the wood forms. All sheets to be laid with tight joints, the transverse joints breaking, and where necessary, nailed down by 3-inch wire nails with small heads. Upon this layer of cork shall be floated about $\frac{1}{2}$ -inch of Portland cement plaster, 1 to 2 $\frac{1}{2}$ mix.

Upon this the building contractor will pour the concrete floors called for by his specification, and, after these are set, the building contractor will remove his forms.

Any nails in cork sheets are to be drawn and a second layer of 2-inch cork sheets are to be laid in $\frac{1}{2}$ -inch bed of Portland cement plaster as before specified. All joints in this second layer are to break with those in the first in both directions.

The work when set is to be plastered in two coats and wrought to float finish as before specified.

CONCRETE FLOORS WITH TIMBER FINISH.

The concrete flooring will be finished to a reasonably true and flat face, with necessary falls for drainage, by the building contractor.

Upon this base shall be laid a course of 2-inch cork sheets set in $\frac{3}{8}$ -inch bed of hot asphalt.

The insulation contractor is to make the floor dry and clean, and shall, if necessary, heat the concrete face for good joint. Upon this cork shall be laid 3-inch x 2-inch spruce timber sleepers, laid on flat at 39-inch centres.

After this work is set, the cork shall be flooded with about $\frac{3}{8}$ -inch hot asphalt, and as run, a second layer of 2-inch cork sheets shall be bedded between the sleepers, all joints breaking with first layer; all joints pressed tight and true, and where necessary held in true position by 4-inch wood skewers driven on skew.

The exposed surface of cork sheets shall be flooded with about $\frac{1}{8}$ -inch bed of hot asphalt, and upon this shall be laid a 1 $\frac{1}{4}$ -inch T. and G. pine flooring securely nailed to sleepers. This flooring to be covered with two layers of 3-ply waterproof paper properly lapped and secured.

Upon this shall be laid 2-inch removable pine flooring as specified later.

CONCRETE CEILING INSULATION.

The under side of existing concrete ceiling shall be insulated as follows:—

A layer of 2-inch cork sheets shall be secured by $\frac{1}{2}$ -inch bed of Portland cement plaster of 1 to 1 $\frac{1}{2}$ mix. All cross joints to break.

D. S. KEITH,
Treasurer.

ALEX. KEITH,
Vice-President

D. FORBES, KEITH,
Manager

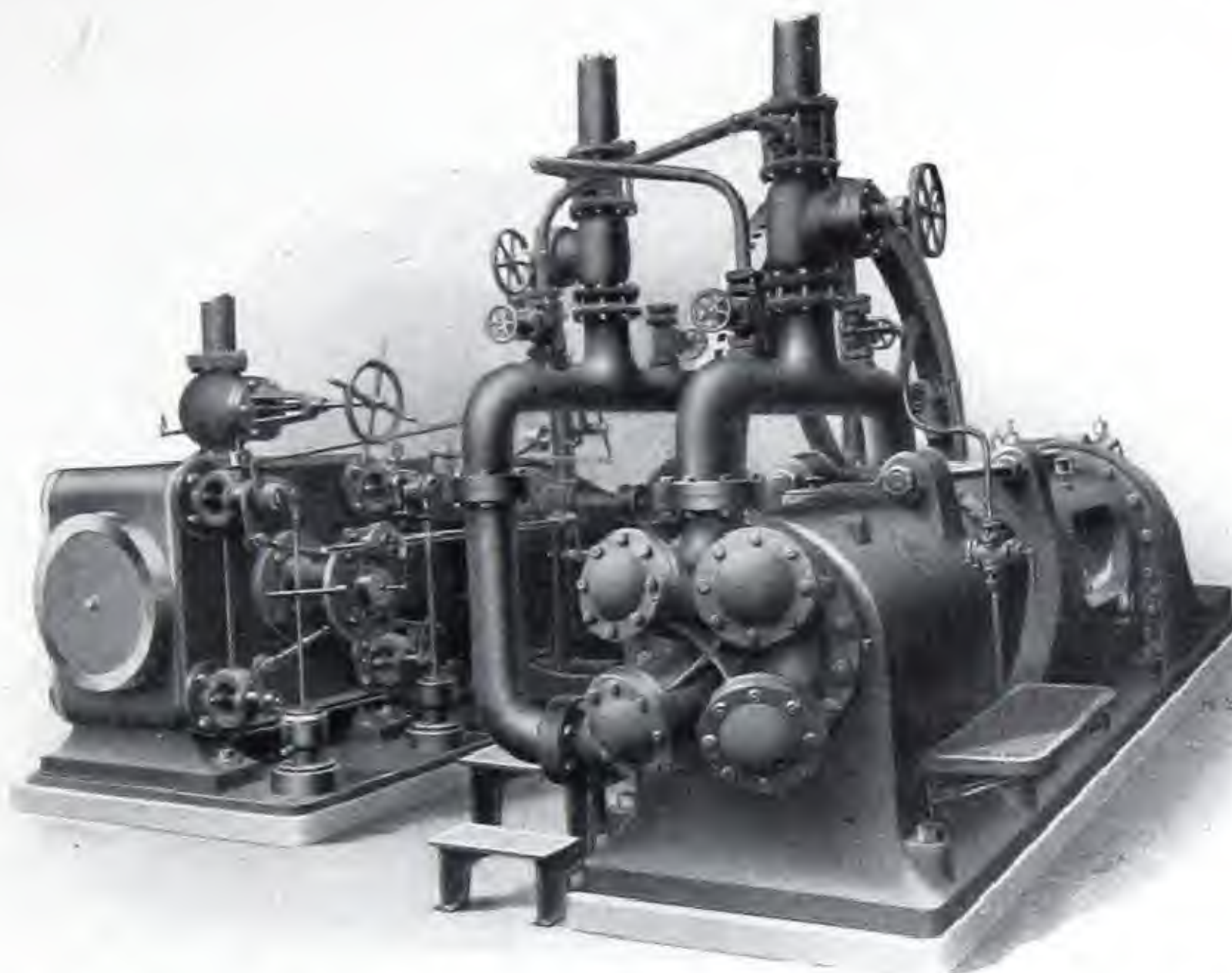
G. A. KEITH,
Sales Mgr.

KEITHS LIMITED

TORONTO AND MONTREAL

Head Office—
295 Campbell Ave.
Toronto

Quebec Branch—
707 New Birks Bldg.,
Montreal



REFRIGERATING ENGINEERS AND CONTRACTORS

Products Cold Storage Insulation, Ice and Refrigeration Machinery.

Service Our Ice, Refrigeration and Cold Storage Insulation department is under the supervision of qualified Engineers and is at your service. We will gladly advise, recommend and estimate on your requirements. No obligation involved in consulting us.

Experience We represent the Frick Company in Canada. Thirty-three years reputation and experience is behind all the work we execute. Write us for information at our Montreal or Toronto office. A card or phone call will receive prompt attention.

**Some of
our
Contracts**

London Pure Milk Co., London, Ont.
Ernscliffe Apartments, Toronto, Ont.
Kormann Brewery, Toronto, Ont.
Public Market, Maisonneuve, Que.
Consolidated Milk Co., Montreal, Que.
Willaton Apartments, Toronto, Ont.
Martineau & Co., Montreal, Que.

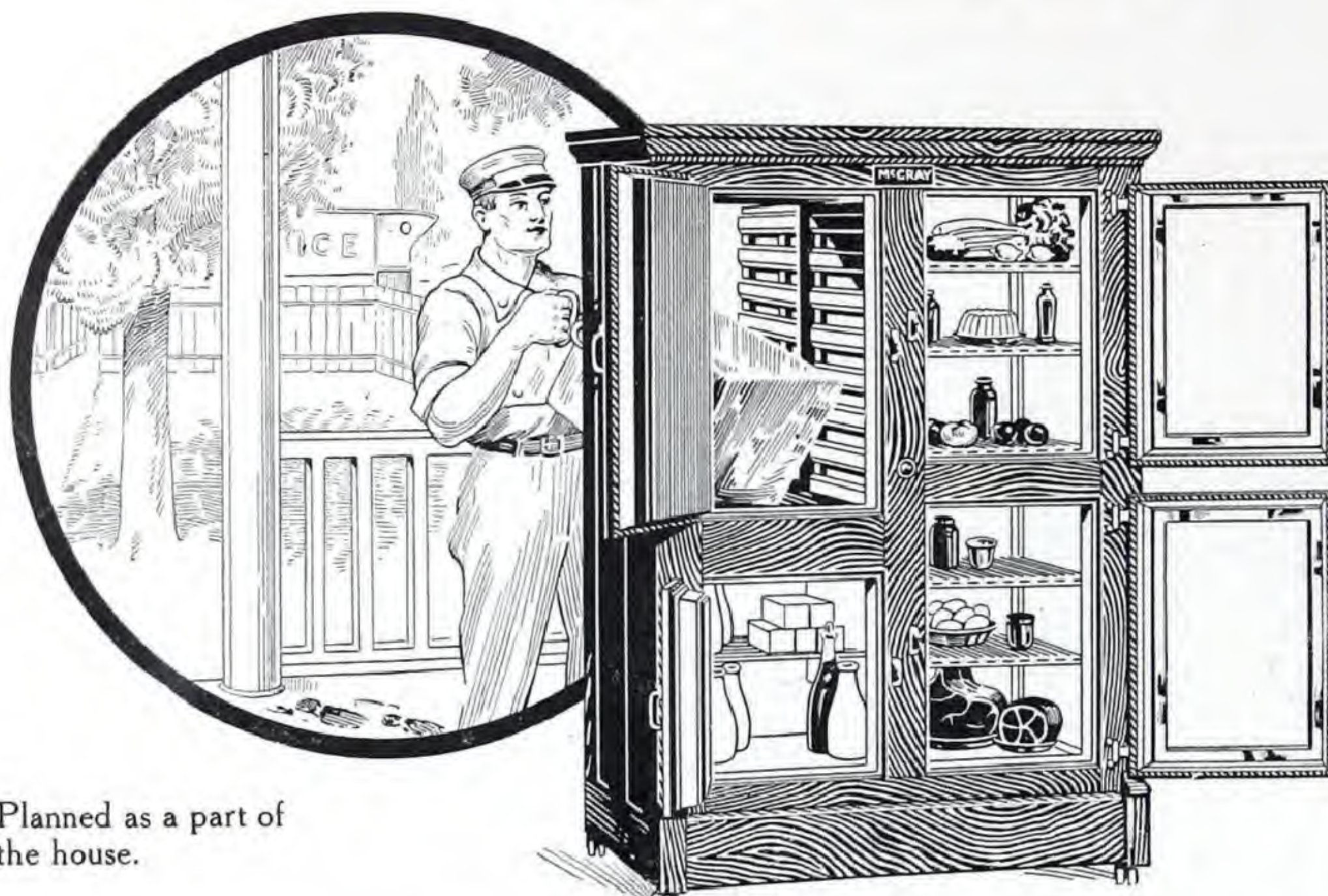


GEO. E. SIEBERT

208 DONALDSON BLOCK
WINNIPEG :: MAN.

Sole Distributor for . .

McCray Sanitary Refrigerators



Planned as a part of
the house.

Arrange- ment

Arranged with outside icing door that keeps the ice man and all his muss and dirt outside the home. This is an arrangement that will at once appeal to every home builder.

Experience

For Thirty Years the McCray has been recognized throughout the world as the Standard of Refrigerator superiority and is used in the finest Residences, Hotels, Clubs, Restaurants, Pure Food Laboratories and large Institutions.

Our System

The McCray system of construction induces a positive circulation of pure, cold, dry air that is impervious to germs, odors and impurities.

Interior linings of opal-glass, porcelain, white enamel or odorless white wood that are sanitary and easily cleaned.

McCray Refrigerators and Coolers, regular stock sizes or special built-to-order are designed to meet every requirement and absolute satisfaction guaranteed.

Service

Our Special Designing Department is at your service without charge or obligation. Send your refrigerator and cooler problems to us and carefully worked out floor plans and estimates will be submitted.

Any of the following catalogues upon request:—

Catalogues

- No. 91 Regular sizes for residences
- No. AH Built-to-order for Residences.
- No. 50 For Hotels, Clubs, Restaurants, Institutions, Etc.
- No. 69 For Grocers.
- No. 60 For Meat Markets.
- No. 73 For Florists.

ROBINSON BROS. CORK COMPANY, LIMITED

Head Office:

803 LUMSDEN BUILDING, TORONTO

Works:

PORT COLBORNE, ONT.

Product Corkboard Insulation for all kinds of Refrigerating and Cold Storage Work.

**Manufac-
ture** Our Corkboard contains absolutely no other substance but Pure Granulated Cork. This is baked by **Electricity** in specially built ovens of our own design, thus ensuring that perfectly even temperature to which the superior quality of our product is due.

Supplied in sheets 36 in. long x 12 in. wide, and in thicknesses, 3 in., 2 in., 1½ in. and 1 in.

**Applica-
tion** The best practice is to employ two layers of Corkboard, the first layer being embedded in cement, mortar or hot pitch previously applied to the wall, cement or pitch being similarly applied between the two layers of Corkboard. The outer surface of the second layer of Corkboard should then be covered with cement plaster brought to a smooth finish.

Write to us for prices and references. Consult us regarding specifications for any form of insulation and refrigeration.

MADE IN CANADA

NOTES ON ROLLING PARTITIONS

Rolling partitions have become very necessary features in the construction of church and school buildings. They are made to close or roll to the top or sides. The vertical rolling partition coiling either on one or both sides of the opening can be made to close a space up to fifty feet without the use of posts. Opening of any width can be closed with one or more horizontal partitions. By the use of movable posts a clear floor is secured, when partitions are rolled up. Single partitions should not be over fifteen feet wide.

Rolling partitions can be readily adapted to any architectural treatment as the casing and finish can be arranged to harmonize with the surroundings.

The partitions are counterbalanced by means of springs or other devices and several methods of operation are employed depending upon the size and weight of the door. For small doors a handle is fitted in the bottom bar: for large partitions an endless chain or crank and gear can be used.

ROLLING PARTITION SUGGESTIONS.

The most efficient way of equipping the modern school with rolling partitions is illustrated by accompanying cuts.

The fronts of the class rooms are usually most conveniently closed by the horizontal (rolling to top) partitions, while the dividing partitions are vertical (rolling to side). This allows the standards or columns to be as small as the weight they have to sustain will allow, thus reducing the sight obstruction to a minimum.

METHODS OF INSTALLING.

Horizontal (rolling to top) partitions may be installed under the head or at side of head as per sections shown. The rollers need not be boxed in unless so desired.

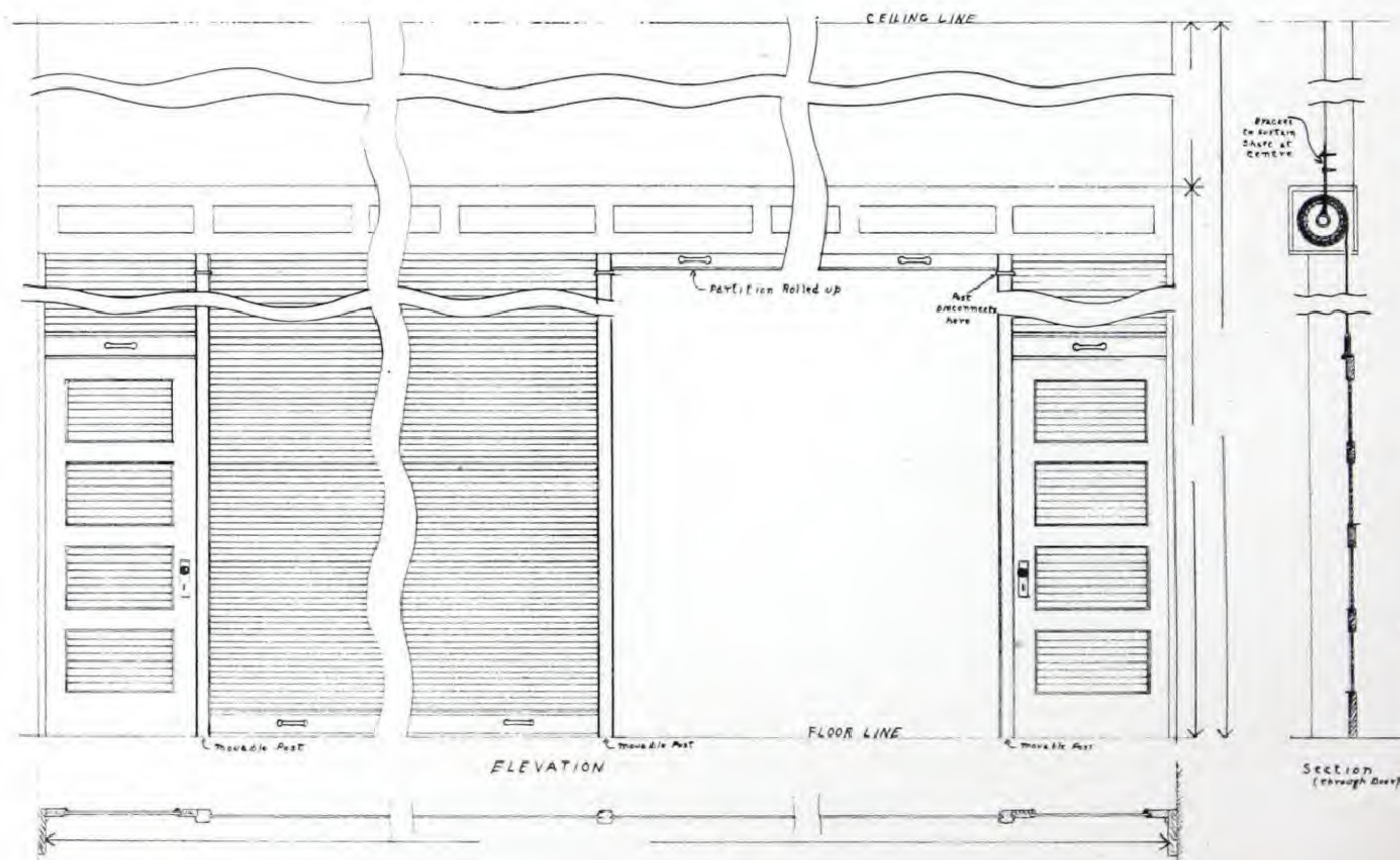
Provision is often made so that the rollers for horizontal partitions are placed between joists or behind cornices.

Horizontal partitions should not be wider than fifteen feet in one section. If the opening to be closed is wider than this it should be installed in two section with centre post made movable, if desired.

For convenience, horizontal partitions frequently have a door at one side (see cut), the post being made movable so that the opening can be cleared of all obstruction.

WEIGHT OF HORIZONTAL PARTITIONS.

In arranging for the installation of rolling partitions figure the weight at 30 lbs. per foot in width.



No. 1

Plan showing Sectional Horizontal Partitions with doors at side. Posts can be removed and doors swung back against wall leaving space perfectly clear.

COILING SPACE REQUIRED.

Height of Partition in feet	Coiling space required
7	12 in. x 12 in.
8	12½ in. x 12½ in.
9	13 in. x 13 in.
10	13½ in. x 13½ in.
11	14 in. x 14 in.
12	14½ in. x 14½ in.

BLACKBOARD SURFACE.

Blackboard surface can only be put on the side opposite the roller.

VERTICAL PARTITIONS.

Vertical partions usually roll back into box at wall (see plan). The metal track on which they operate can be either flush with finished floor or laid on top of floor.

COILING SPACE.

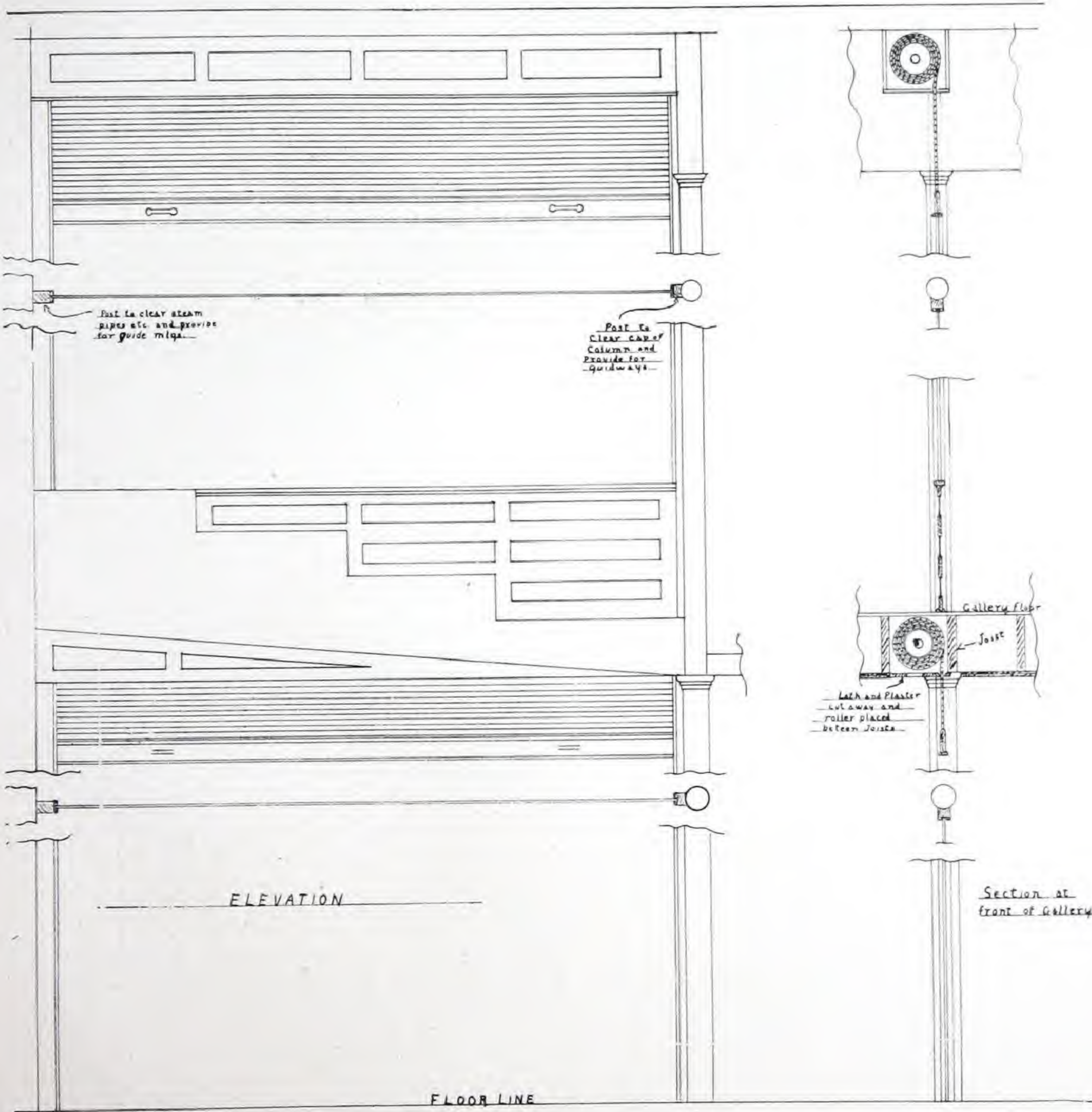
Coiling space required for vertical (rolling to side) partitions is as follows:

Width of Opening in feet	Coiling space required
7	13½ in. x 13½ in.
8	14¼ in. x 14¼ in.
9	15 in. x 15 in.
10	15¾ in. x 15¾ in.
11	16½ in. x 16½ in.
12	17¼ in. x 17¼ in.
13	18 in. x 18 in.
14	18¾ in. x 18¾ in.

FINISH OF PARTITIONS.

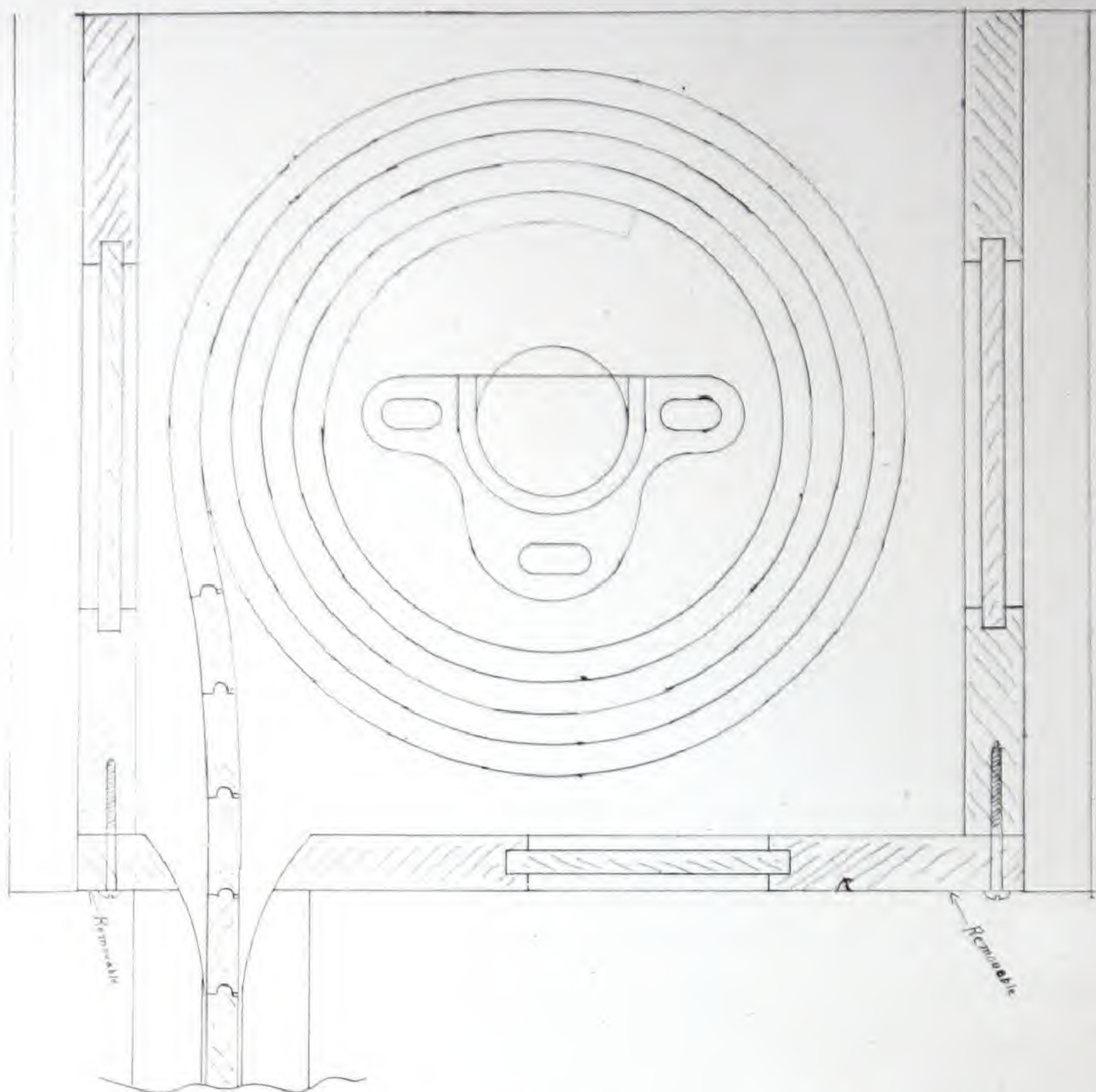
All partitions should have French polish non-scratchable finish before assembling.

Any kind of wood desired can be used.



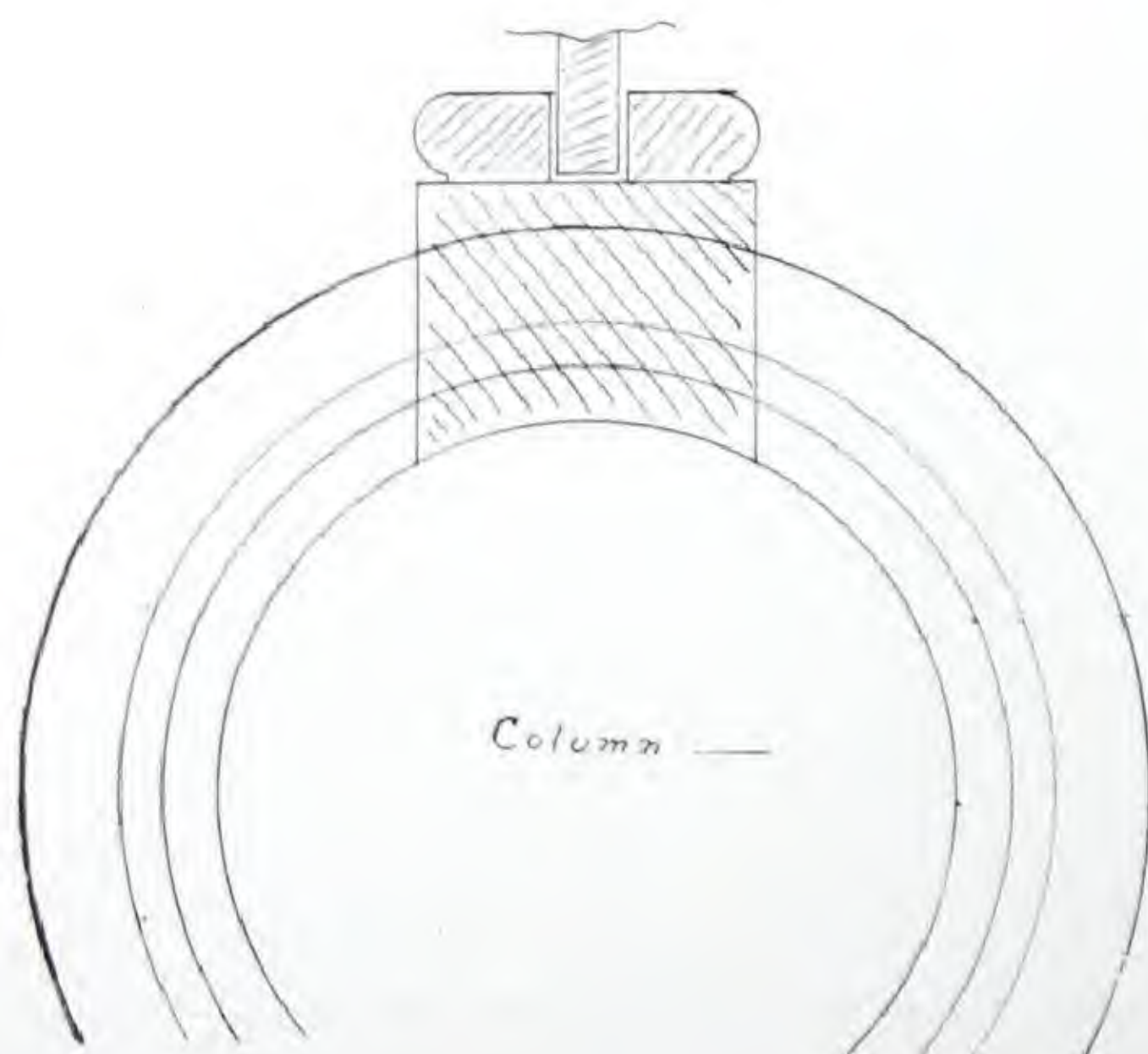
No. 2

Plan showing method of installing Horizontal Rolling Partitions (rolling top) between class rooms in gallery and on the main floor of Sunday School Auditorium. This plan does not provide for partitions at front of class-rooms. Pieces scribed to columns should be as small as possible so as to reduce the sight obstruction to a minimum.



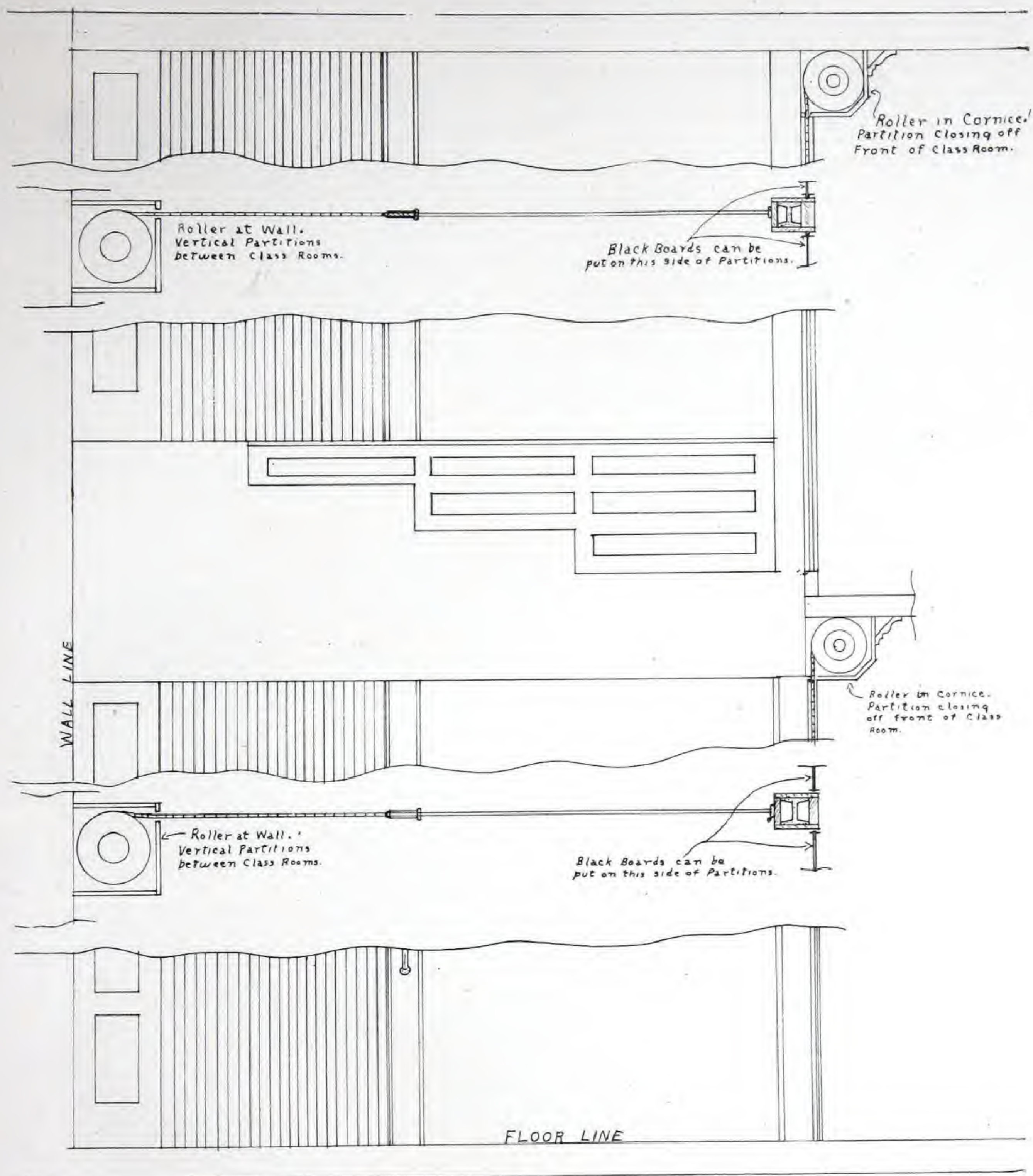
No. 3

Detail of Horizontal Partition Roller (see No. 2).



APPROXIMATE COILING SPACE REQUIRED

Height of Opening	Size in inches	
7 feet	12	x 12
8 feet	12½	x 12½
9 feet	13	x 13
10 feet	13½	x 13½
11 feet	14	x 14
12 feet	14½	x 14½
13 feet	15	x 15
14 feet	15½	x 15½



No. 4

Suggested method of installing Vertical (rolling to side) and Horizontal (rolling top) Partitions dividing class rooms in gallery and main floor of Sunday School Auditorium. Gives convenient arrangement of Blackboard in front of class rooms.

JAMES G. WILSON MFG. COMPANY

3 West 29th Street

CHICAGO

NEW YORK

NORFOLK, VA.

Products Wilson's Patent Horizontal and Vertical Wood Partitions.
Wilson's Hygienic Wardrobe, Venetian Blinds and Awnings.

Rolling Partitions Rolling Partitions have become a very necessary factor in school and church construction. Our Partitions have been used in over twenty-five thousand of these buildings.

Vertical Rolling Partitions

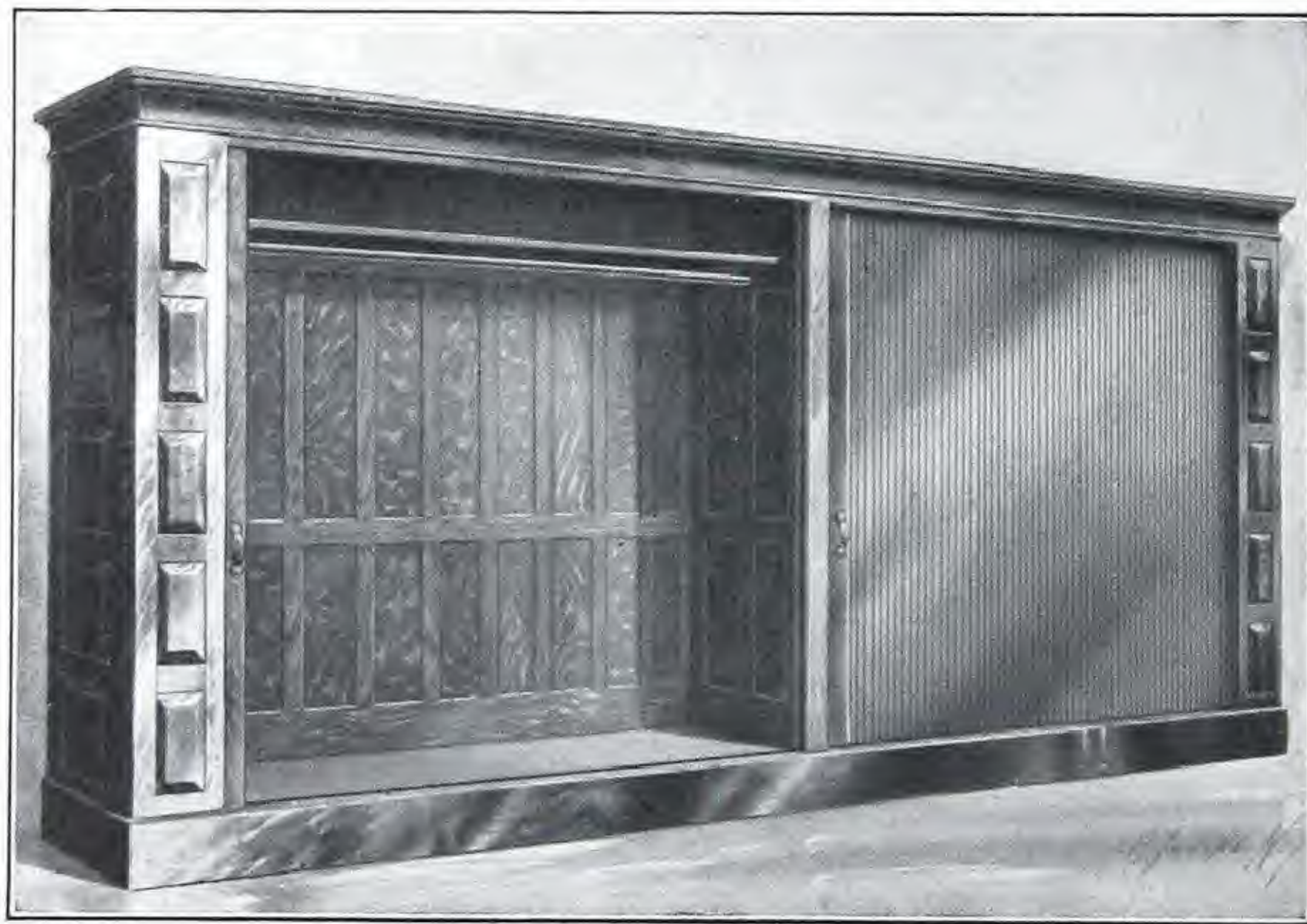
Coiling on either one side or both sides of the opening. A 50 ft. space can be closed without the use of movable posts.

Horizontal Rolling Partitions

Auditoriums or Churches with large openings movable posts are used.



Vertical Rolling Partitions



Style D.—Wilson's Vertical Rolling Hygienic Wardrobes



Horizontal Rolling Partitions

Wilson's Hygienic Wardrobes

As shown are made in several styles adapted to school use or other institutions. The arrangement shown in the illustration is one scheme of ventilating our wardrobes. The air being drawn into the wardrobe passes out through the air shaft thereby avoiding unpleasant odors from wet clothes. All wardrobes equipped with hooks, shelves, racks, etc.

Prices, Catalogues Testimonials

Furnished on request from the New York Office or nearest Agent.

WATSON LIMITED

WATSON ROLLING PARTITIONS

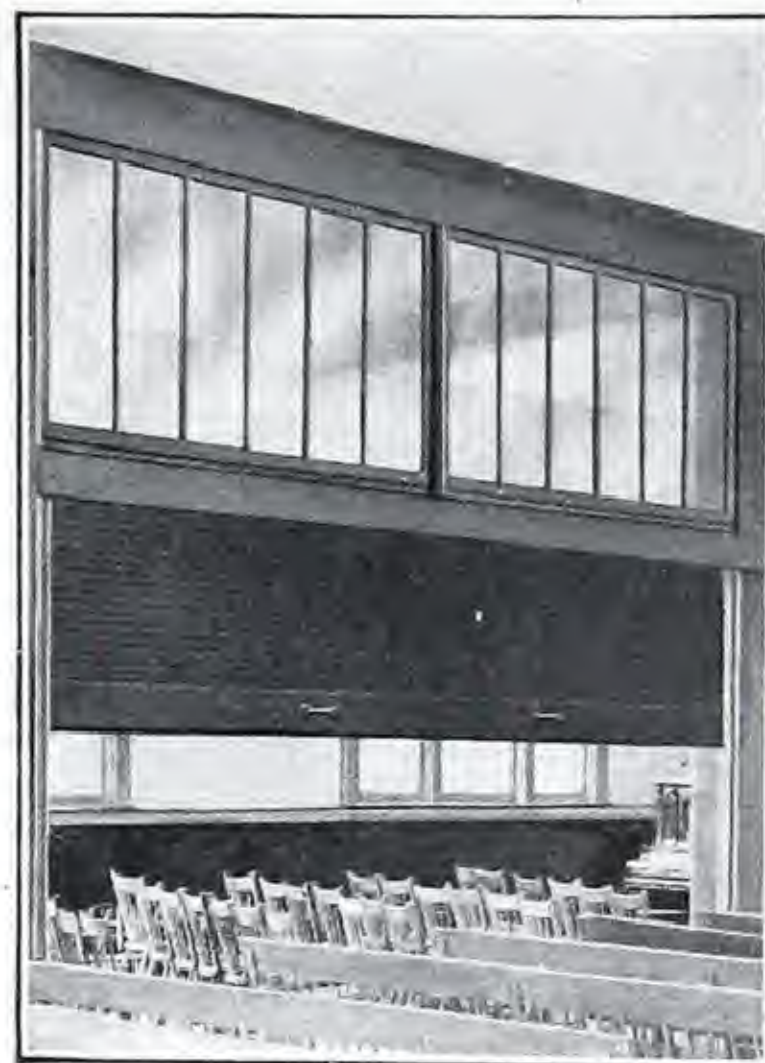
Head Office & Factories

- -

Bradford, Ontario

Product Manufacturers of the well-known **Watson Rolling Partitions**. The modern method of closing off floor space in Residences, Schools, Churches, Public Libraries, and all Public Buildings.

We also make a line of High-grade Window and Door Screens.



Advantages Among the many advantages of the Watson Rolling Partitions over old style solid partition may be mentioned:

—Greatest Economy of Floor Space, Simplicity in Construction, Ease of Operation, Reliability, Attractive Appearance, and all the advantages of a Movable Partition.

Construction **Watson Rolling Partitions** are composed of narrow slats (tongued and grooved) threaded upon steel bands. They roll up like a shade—either overhead or at the side. Anchor springs embedded in the base of the partition are provided to take care of expansion and contraction in coiling. **Watson Verticals** (rolling to the side) are equipped with steel sheaves and track, making operation easy and noiseless.

Co-operation Write us, or send us sketch, before deciding on the plan of your building and we will gladly make suggestions, furnish estimates and information concerning Rolling Partitions without expense to you.

Send for Further Particulars.

SCREENS AND WEATHER STRIPS

NOTES ON INSECT SCREENS.

Doors.

Every door frame should be provided with a rabbet on the outside, with sufficient space between such rabbet and door to give plenty of room for hardware of both house and screen doors.

Sills should extend to the outer edge of screen door rabbet, so that screen doors can finish there. Screen doors should never extend to the balcony or veranda floor, as they interfere with mats, and they either leave the wire unprotected at the sill inside or necessitate a wide and unsightly bottom rail.

French Windows With Shutters.

There are the most difficult openings to screen for the following reasons: The screen door must go between the house doors and the shutters. It must open in. In opening in it must clear both the sill at the bottom and the house door at the side to an angle of at least degrees.

In order that the screen door may clear the house door when opened, the screen rabbet should project at least $1\frac{1}{4}$ inches from the face of the jamb. This is usually and most conveniently accomplished by a hanging stile planted on the face of jamb. In any case a flat jamb surface should be provided sufficient for the following.

Between inside edge of blind rabbet and screen door (to allow for hardware), 2 inches. Thickness of screen door, $1\frac{1}{4}$ inches. Between screen door and house door (to allow for hardware), at least 3 inches. Total, $6\frac{1}{4}$ inches.

The hanging stile above mentioned can then be placed at any time.

The threshold necessary when screen door open in, can be fixed permanently; extending to house door, or grooved on under side to let water drain off, or it can be made removable and taken away with screens in the Fall.

Double Hung Windows.

Double hung windows should have an extra hanging stile $1\frac{3}{4}$ inches thick, so that a space of $1\frac{3}{4}$ inches will be allowed between the screen and the outside blind or storm sash rabbet. This allows sufficient room for the screens, blinds, and storm sash to operate, without the hardware of one interfering with the other, and gives plenty of room for a good blind adjuster without interfering with screen. A sliding screen generally extends from sill to top of meeting rail and should operate on outside lining close to the top sash.

Casement Windows Opening In.

Casement windows opening in, should have at least $2\frac{1}{2}$ inches of flat jamb surface between the sash and the blind or storm sash rabbet, clear of all water bars, hardware, etc. This allows room for twin sliding screens, which are necessary if outside blinds or double sash are required on the window with the screens.

Casement Windows Opening Out.

Casement windows opening out should have a rabbet at least $\frac{1}{2}$ inch by $\frac{7}{8}$ inch provided on the inside of the frame. This should be of sufficient distance from the sash to clear all casement fasteners and adjusters (telescope adjusters should be used). The screen rabbet at bottom should be raised at least $\frac{1}{2}$ inch above sill to prevent the possibility of screen rubbing sill when opened.

A flat jamb surface of at least 2 inches should be provided, clear of all casement fasteners and adjusters, so that twin sliding screens can be used if desired.

The casement catch should be put 2 or 3 inches below the centre of sash, so that (if twin sliding screens are used) the catch is accessible when the lower half of screen is raised to top of window.

WEATHER STRIPS

No general specification clause can be written to apply to all forms of weather strips, for the reason that the application of some kinds of strips is quite different to others. The oldest form of weatherstrip consists of the well-known bead, rabbeted on one side with a strip of felt cemented into the rabbet. This form of weather strip, although much better than none, in time loses its efficiency due to wear or change of shape of the felt strip.

There are at present on the market a number of patented metal weather strips of various forms, which, with ordinary usage, are practically indestructible. The application of these strips is always carried out by the manufacturers, and no specification is necessary

other than a clause to the effect that they must not interfere with the free working of the windows or doors and must fulfill all the conditions stated in the guarantee under which they are usually sold.

EFFECT OF WEATHER STRIPS.

There is no question of the fact that in ordinary buildings the principal heat loss is due to convection, especially where the windows and doors are not well fitted. The heat losses of this kind are so uncertain that no rational provision can be made for them when laying out the heating system, unless some assurance of good workmanship can be obtained, either from observation of the fin-

ished work or the proposed character of the construction. Under ordinary circumstances all formulae in use for determining heat losses make liberal allowance for heat being carried out of the building through leakage of heated air. And cases are by no means rare in which a properly installed heating system, layed out by means of orthodox methods, proves to be inadequate, or at least very extravagant in the matter of fuel consumption. It is to check this unnecessary waste of heated air that weather strips have been developed, for it is not at all necessary for ventilation purposes. Very often the application of weather stripping is followed by a

reduction in coal consumption amounting to twenty-five per cent. In addition to the above the weather strip prevents a large amount of street dust from finding its way into the building, and also holds the sash in possition, preventing rattling. The following tables are the result of experiments carried out to determine exactly the percentage of reduction in radiating surface required to maintain the desired room temperature with windows equipped with metal weather strips. All disturbing conditions were eliminated and the temperatures kept constant.

The following tables give the percentage of square feet of radiating surface which may be saved by equipping windows with weather stripping.

SINGLE CASEMENT WINDOWS

Height in inches	Widths						
	24	30	36	42	48	54	60
30	1.46	1.63	1.8	1.95	2.12	2.27	2.43
36	1.63	1.8	1.95	2.12	2.27	2.43	2.6
42	1.8	1.95	2.12	2.27	2.43	2.6	2.76
48	1.95	2.12	2.27	2.43	2.6	2.76	2.93
54	2.12	2.27	2.43	2.6	2.76	2.93	3.1
60	2.27	2.43	2.6	2.76	2.93	3.1	3.26
66	2.43	2.6	2.76	2.93	3.1	3.26	3.42
72	2.6	2.76	2.93	3.1	3.26	3.42	3.59
78	2.76	2.93	3.1	3.26	3.42	3.59	3.75
84	2.93	3.1	3.26	3.42	3.59	3.75	3.92
90	3.1	3.26	3.32	3.59	3.75	3.92	4.08
96	3.26	3.42	3.59	3.75	3.92	4.08	4.25
102	....	....	....	....	....	....	....
108	....	....	....	....	....	....	....

In addition to amount shown on table, omit 75 per cent. of amount usually added for unusual northern glass exposure.

DOUBLE-HUNG AND DOUBLE-CASEMENT WINDOWS

Widths						
24	30	36	42	48	54	60
....
....
....
2.28	2.50	2.76	3.	3.25	3.5	3.75
2.43	2.68	2.92	3.17	3.41	3.65	3.9
2.6	2.85	3.09	3.33	3.6	3.82	4.07
2.76	3.	3.25	3.5	3.75	4.	4.23
2.92	3.17	3.41	3.65	3.9	4.14	4.39
3.09	3.33	3.6	3.82	4.06	4.28	4.55
3.24	3.49	3.73	3.98	4.22	4.47	4.71
3.41	3.65	3.9	4.14	4.39	4.6	4.88
3.6	3.82	4.06	4.28	4.55	4.8	5.04
3.75	4.	4.23	4.47	4.7	4.95	5.2
3.9	4.14	4.39	4.63	4.88	5.12	5.37

The figures given are based on zero outside and 70 degrees Fah. inside temperature.

WHEN REPLYING TO ADVERTISERS, KINDLY MENTION "REFERENDEX"

THE CHAMBERLIN METAL WEATHERSTRIP COMPANY, LTD.

KINGSVILLE, ONT.

Toronto Office: 598 Yonge St.
Winnipeg Office: 707 Boyd Block

Phone North 4292
Phone Main 5391

Highest Award
Pan American Exposition
Buffalo, 1901

Gold Medal
World's Fair
St. Louis, 1904

Gold Medal
Lewis & Clark Centennial
Portland, Ore., 1905

Bronze Medal
and Diploma
Toronto Exhibition
1906

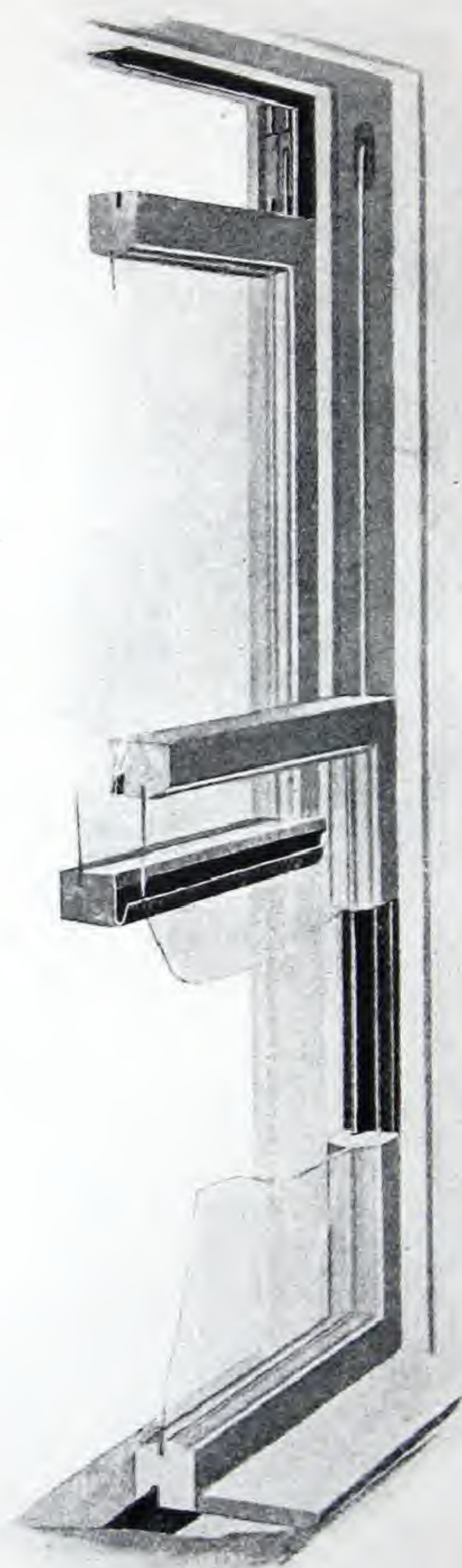
Agencies in every City and all leading Towns in Canada

Products "Chamberlin" Metal Weather Strip for Windows and Doors.

Services Installing "CHAMBERLIN" Metal Equipment to stop leakage, to eliminate draughts, to keep out dust and noise, to perfect the operation of the sash, to insure even heating of the building throughout, to assist heating and ventilating plants so as to secure maximum efficiency. The equipment is all metal, either solid zinc, copper or bronze. It can be installed in either old or new buildings of any kind and for any size or shape of window or door.

Specifications All windows to be equipped with metal weather strip as follows:—
Sliding or Double-Hung Sash—
Window frames to be equipped at sides, top and bottom with one-piece metal strips, having beaded-edge sealing ribs extending at right angles $\frac{3}{8}$ inch, ribs to enter grooves ploughed in edge of sash; the metal side strips to have raised bearing points on their bases, and the said bases of the strips to cover the entire width of sash channels or runways, one edge to extend into a small groove in parting stops. Meeting rails to be equipped with two members; one on the lower edge of the lower rail of upper sash, the other on the upper rail of lower sash, on putty bar face; said members (one hooked and the other bent on itself) interlocking when sash is closed.

Casements or Hinged Windows—
To be equipped on hinge side of frame and sash grooved same as in sliding windows. On top, bottom and side opposite the hinges the strip to consist of two parts, one of which is fastened to the jamb, head and sills, and the other to the side, top and bottom of casement in such a manner that they interlock when the window is closed, same as meeting-rail of sliding sash. In opening casements, where there is no rabbet, to be provided with sub-sills and water tables, or casements may be equipped with spring bronze on front, side and top.



Application of "CHAMBERLIN" equipment to double hung windows

THE CHAMBERLIN METAL WEATHERSTRIP COMPANY LIMITED

KINGSVILLE, - ONT.

Weather strips on sides of double-hung windows to be of No. 9 gauge zinc; heads and sills to be of No. 10 gauge zinc; hooked meeting-rail strips to be of No. 12 gauge zinc, the other meeting-rail member to be of No. 9 gauge. Installation of strip to be done by manufacturer's expert workmen.

Weather strips guaranteed to cause windows to slide smoothly and easily, and all repairs or attention necessary in this connection to be made by party installing same, for a term of ten years, free of cost.

Reducing Size of Radiators

Less radiation is required where the Chamberlin System is installed. It is often possible to reduce the size of the heating plant sufficiently to pay for the entire cost of weatherstripping installation. We maintain an Engineering Department to consult with architects and heating engineers as to the saving that can be made by the installation of Chamberlin Equipment. All figures on heating and radiation must come from the General Offices of the Company, at Kingsville, Ont., or be signed by an Executive Officer of the Company.

Details

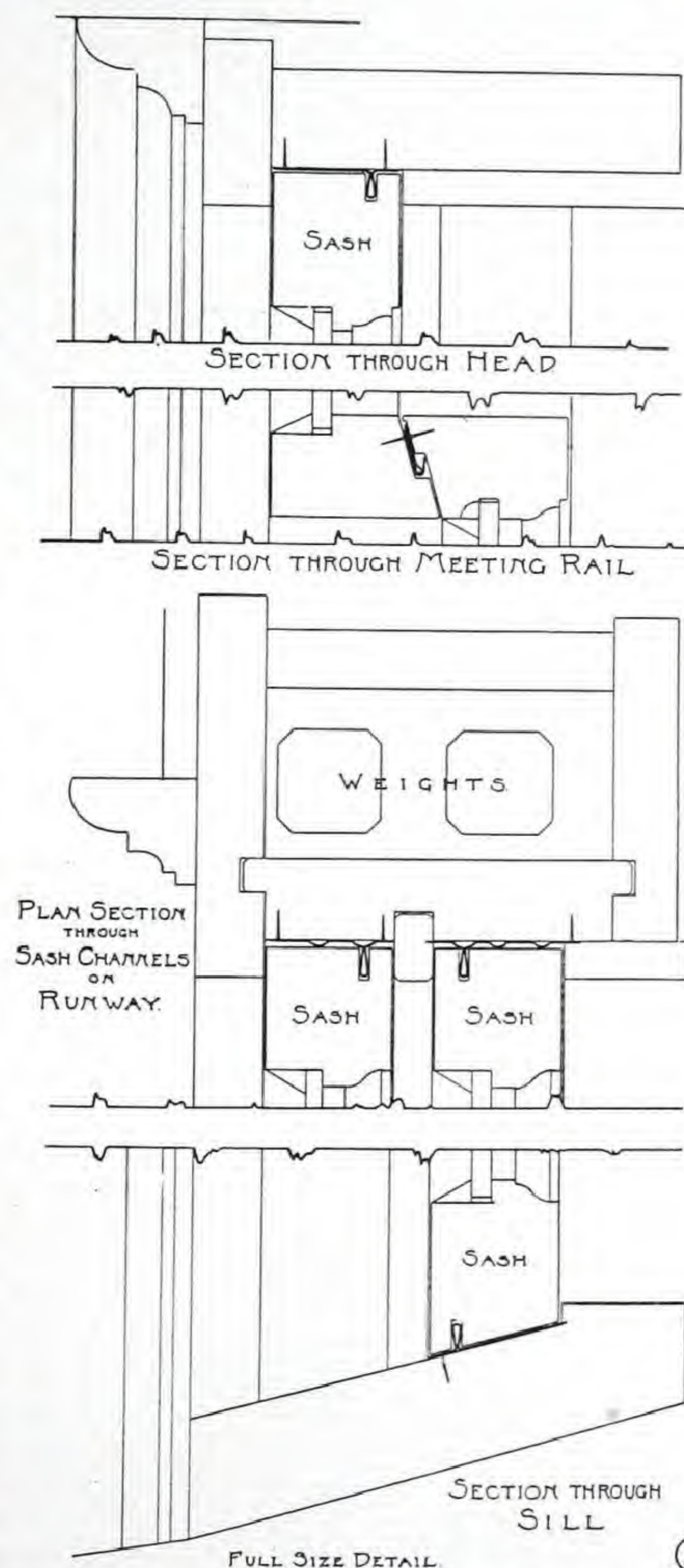
Full-sized details of casements, transoms, doors, etc., mailed upon request.

Estimates

Estimates of cost are made only by authorized representatives of the Company; the equipment is not sold through any dealer.

Installation

Only the Company's own mechanics are allowed to install Chamberlin Equipment. We take the window as we find it and guarantee the proper installation and effectiveness of the equipment. No special preparation of the casing or the sash need be called for in the specifications or plan.



DETAILS OF STANDARD "CHAMBERLIN" CORRUGATED WEATHER STRIPS AS APPLIED TO DOUBLE-HUNG WINDOWS

CROWN METAL WEATHERSTRIP CO.

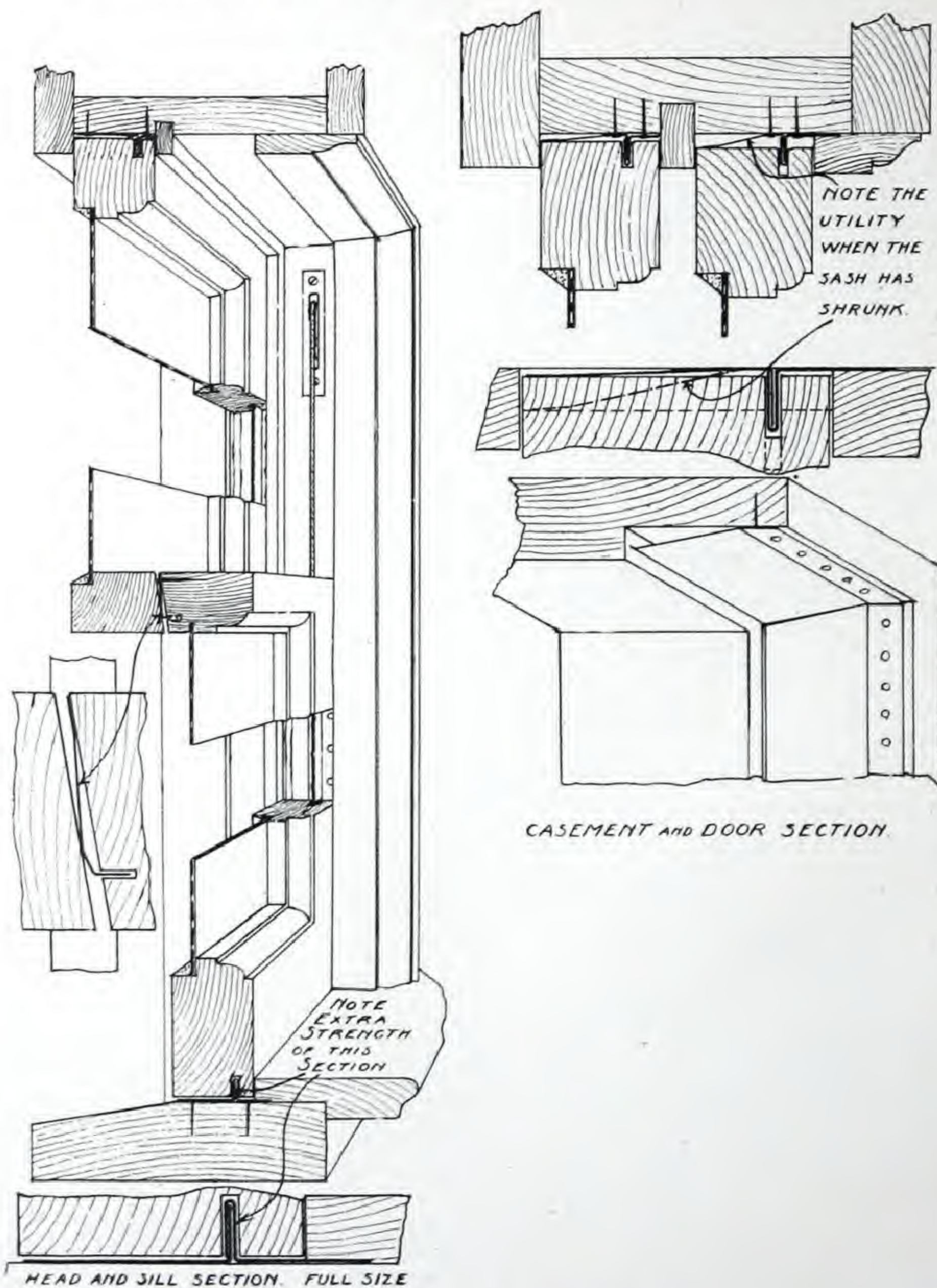
123 Isabella Street

- - - Toronto

Product Manufacturers of Crown Metal Weatherstrip for Doors and Windows.

Advantage The Crown Metal Weatherstrip where installed, is there to stay. When applied to windows excludes Dust, Dirt, Draughts and Cold Winds.

The Crown Metal Weatherstrip will tighten loose sash, excluding street noises and does away with the window rattling nuisance. Will not rust or warp.



Estimates Estimates and samples will be gladly forwarded on request.

DATA RELATING TO PUMPS AND PUMPING

In practice it is found that the actual pumping capacity of the various pumps varies from 60 to 95 per cent. of the theoretical capacity. Depending in each case upon design, tightness of valves, pistons, etc., and friction in pipes and passages. The theoretical capacity can be determined by using the following formulas:—

$$\text{Capacity in cu. ft. per min.} = Q = \frac{11}{4} \times \frac{d^2}{144} \times \frac{1N}{12} = 0.0004545 Nd^2l, \text{ or}$$

$$\text{Capacity in U.S. gals. per min.} = Q^1 = \frac{11}{4} \times \frac{Nd^2l}{231} = 0.0034 Nd^2l, \text{ also}$$

$$\text{Capacity in U.S. gals. per hr.} = Q^{11} = 0.204 Nd^2l, \text{ where}$$

d = diameter of pump in inches.

l = stroke in inches.

N = number of strokes per min.

$$\text{The diameter required for a given capacity per min. is given by } d = 46.9 \sqrt{\frac{Q}{Nl}} = 17.15 \sqrt{\frac{Q^1}{Nl}}$$

$$\text{If } O = \text{piston speed in feet per min. } d = 13.54 \sqrt{\frac{Q}{O}} = 4.95 \sqrt{\frac{Q^1}{O}}$$

Given a piston speed of 100 feet per min.

$$Nl = 1200 \text{ and } d = 1.354 \sqrt{Q} = 0.495 \sqrt{Q^1}$$

The theoretical horse-power required to raise water a given height is given by the following

$$\text{H.P.} = \frac{Q \times p}{33000} \text{ where } Q = \text{cu. ft. per min. } p = \text{press per sq. ft. in lbs.}; \text{ also } \text{H.P.} = \frac{W \times H}{33000} \text{ where } W = \text{weight in lbs. } H = \text{lift in feet.}$$

To obtain the actual horse power an allowance must be made for losses due to friction, etc.

The Suction Head.—A perfect pump would lift water by so-called suction to a height of 34 feet, or the height corresponding to a perfect vacuum. (14.7 lbs. \times 2.309 = 33.95 feet); but since a perfect vacuum is unobtainable, the suction head or lift is generally less than 30 feet. When water is warm the height to which it can be lifted by suction decreases with increase in temperature, due to the pressure of water vapor. In pumping hot water, therefore, the water must flow to the pump by gravity. The actual height decreased by friction of piping, a factor which should have careful consideration for all pump installations.

The velocity of water through the suction pipe must not exceed 200 ft. per min. if excessive friction is to be avoided. The approximate size of suction pipe, where the length does not exceed 25 feet, may be determined as follows: 7/10 of the diameter of the cylinder multiplied by 1/100 of the piston speed

in ft. For duplex pumps of small size use a pipe one size larger than given by this rule.

The discharge velocity should not exceed 500 ft per min., and piping should be figured in each case to allow this velocity as a maximum.

BOILER FEED PUMPS.

In determining the capacity of pumps for boiler feeding, allowance must be made for a supply of water sufficient for the maximum capacity of the boiler when over driven, with an additional allowance for feeding water beyond this amount when the water level of the boiler becomes low. The average run of horizontal tubular boilers will evaporate from 2 to 3 lbs. of water per sq. ft. of heating surface per hour, but this figure may under special conditions be increased to 6 lbs. The following may be taken as safe allowance:

High pressure engines—6 gals. per H.P. per hour.

Automatic cut-off engines—5 gals. per H.P. per hour.

High pressure compound engines—4 gals. per H.P. per hour.

Water tube boilers—3½ gals. per H.P. per hour.

And then select a pump with about 30 per cent. more capacity than is given by the above figures.

CENTRIFUGAL PUMPS.

Centrifugal pumps are those in which the water is given a high velocity by revolving impellers. The velocity of the water on leaving the impeller is reduced by suitably arranged passages and appears as pressure. Higher pressures may be secured by increasing the speed or by arranging two or more impellers in series.

Centrifugal pumps are built with vertical or horizontal shafts to meet the conditions of service. If the vertical shaft type be used, some form of thrust bearing must be provided to take the weight of the impeller and its shaft, and a separate thrust bearing provided for taking the weight of the driving shaft. Means must be provided to adjust each thrust bearing independently of the other.

The horizontal type for many situations will be preferable. There may be, however, situations for which the vertical-shaft type will be better suited, such as a very high suction lift, or where it is not expedient, by reason of dirt and dampness, to place the motor or other prime mover at the same level as the pump. In such cases, by placing the pump down within easy reach of the water and extending the shaft to a higher level, where the motor can be connected and better cared for, the outfit can be made comparable in reliability to the horizontal type at low lifts. Such an arrangement would call for the two thrust bearings above mentioned, independently adjustable to take the weight of the revolving parts.

BOVING & COMPANY OF CANADA, LIMITED

Head Office:
164 Bay Street, Toronto

Works:
Lindsay, Ont.

Branches:
Moose Jaw, Sask., 94 Grafton Avenue - Vancouver, B.C., London Bldg.

OUR HYDRAULIC LINES

Water Turbines
Water Turbine Governors
Welded Steel Pipe Lines
Patent Muff Joints

Turbo Pumps
Hydraulic Valves
Sluice Gates
Strainers, Etc.

OUR MECHANICAL LINES

Diesel Engines
Semi Diesel Engines
Flexible Couplings
Pumping Plants

Pumping Machinery
Stump Extractors
Tachometers
Tachographs, Etc.

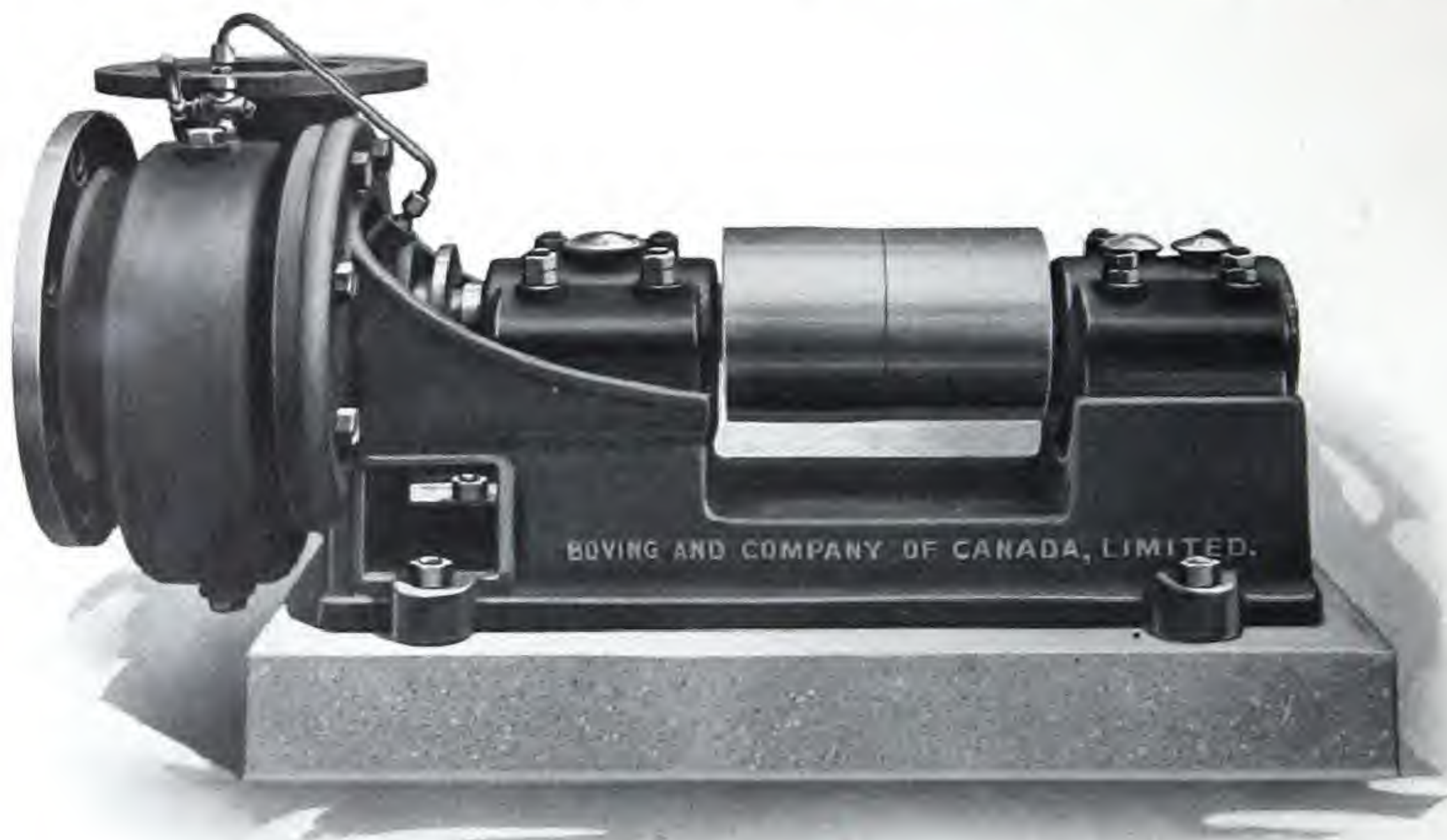


Illustration shows 6 in. Contractors' Pump

Our Contractors Pumps are Belt Driven Low Pressure Pumps of solid and durable design. Built for Heavy duty.

LET US QUOTE ON YOUR REQUIREMENTS.

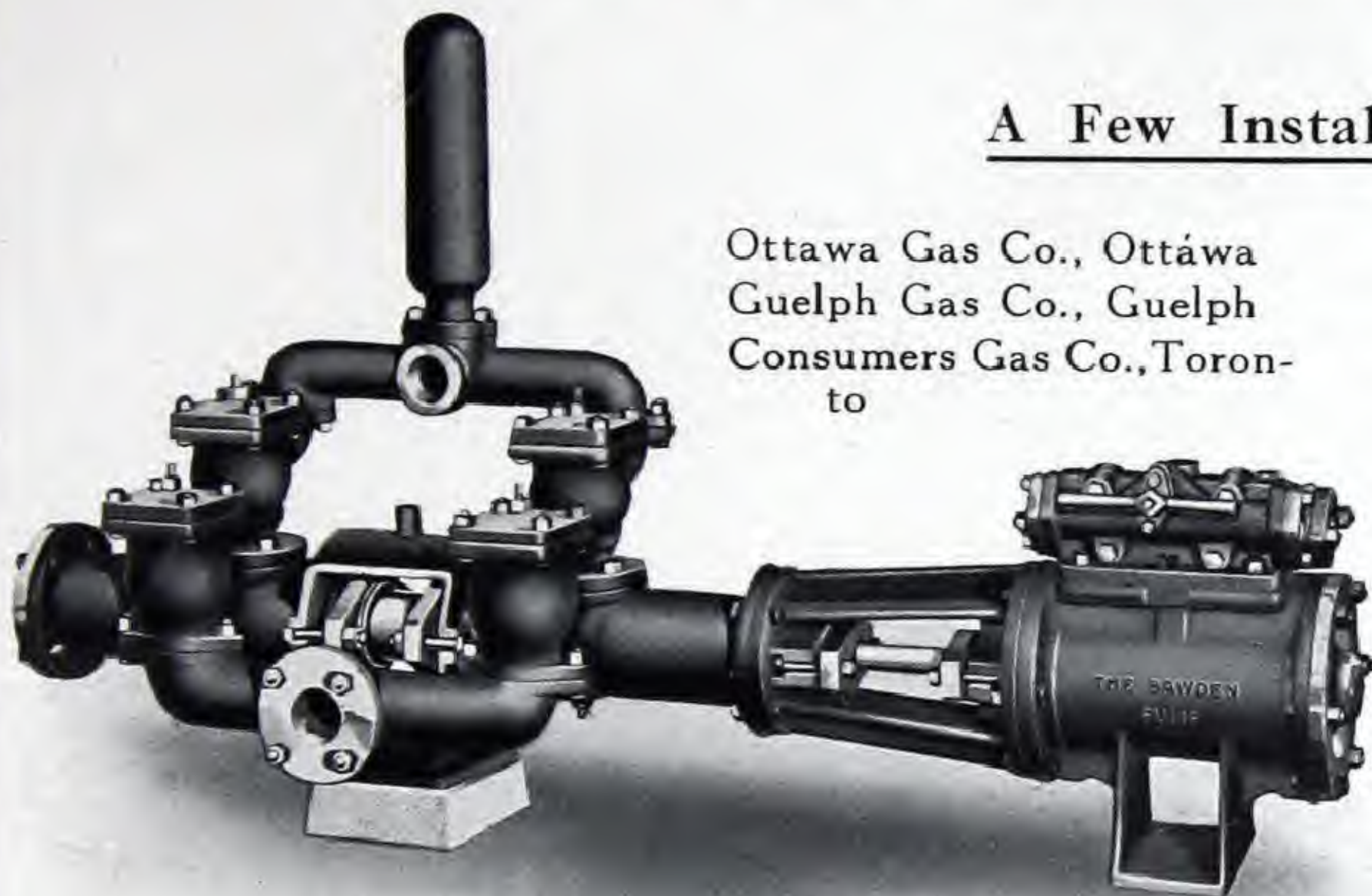
Pumps for all purposes, Belt Driven, Direct Connected, High, Medium and Low Pressure.

BAWDEN MACHINE CO. LIMITED

Steam and Power Pumping Machinery

133 STIRLING ROAD, - - TORONTO, ONT.

Product Pumping Machinery, Steam and Power-driven for High and Low pressures and all purposes including Boiler-feed, General Service, Vacuum, Tank, Elevator, Accumulator, Brine, Tar, Mash, etc.



A Few Installations

Ottawa Gas Co., Ottawa
Guelph Gas Co., Guelph
Consumers Gas Co., Toronto

A. B. Ormsby Ltd.,
Toronto

Parkers Dye Works,
Toronto

Metallic Roofing Co.,
Toronto

Ontario Sewer Pipe Co.,
Mimico

Kilgour Bros., Beaumaris,
Que.

Bank B.N.A., Montreal

C. A. Dunham Co., Toronto

Bennett & Wright Co.,
Toronto

Separate Pot Valve Centre Outside Packed Ram Type Pump.

Operated By the Bawden Patent Steam Moved Piston Valve which is the simplest on the market, there being no springs, tappets, internal tubes, or packing glands in the steam end. Absolutely nothing to go wrong or get out of order.

Advantages It makes a full stroke of the piston under all conditions. Will run at any speed under constant or varying pressures or vacuum with no knock or bang. There are no outside rods to get out of adjustment or keep oiled and no adjustments of any kind to make for varying conditions.

Design All Bawden Pumps are designed with the main idea of giving the Engineer easy access to all working parts.

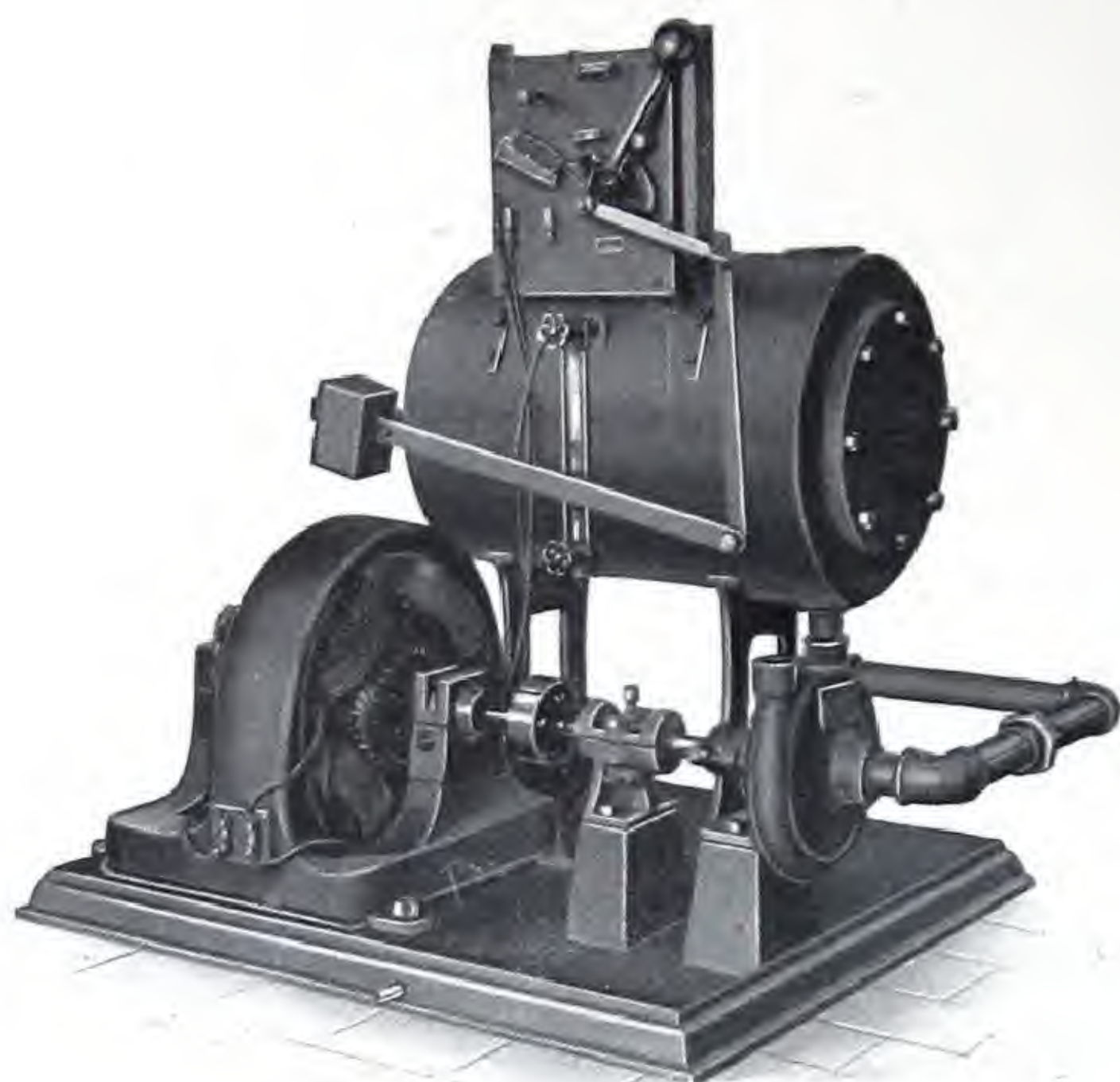
Positive Action Steam valve gear on all Bawden Pumps are as positive in action working with water pressure as with steam pressure; this allows them to start when submerged in water and proves they have no dead centres.

Test All Pumps are carefully tested under their own steam or power before leaving our works and carry a rigid guarantee as to workmanship, material and service.

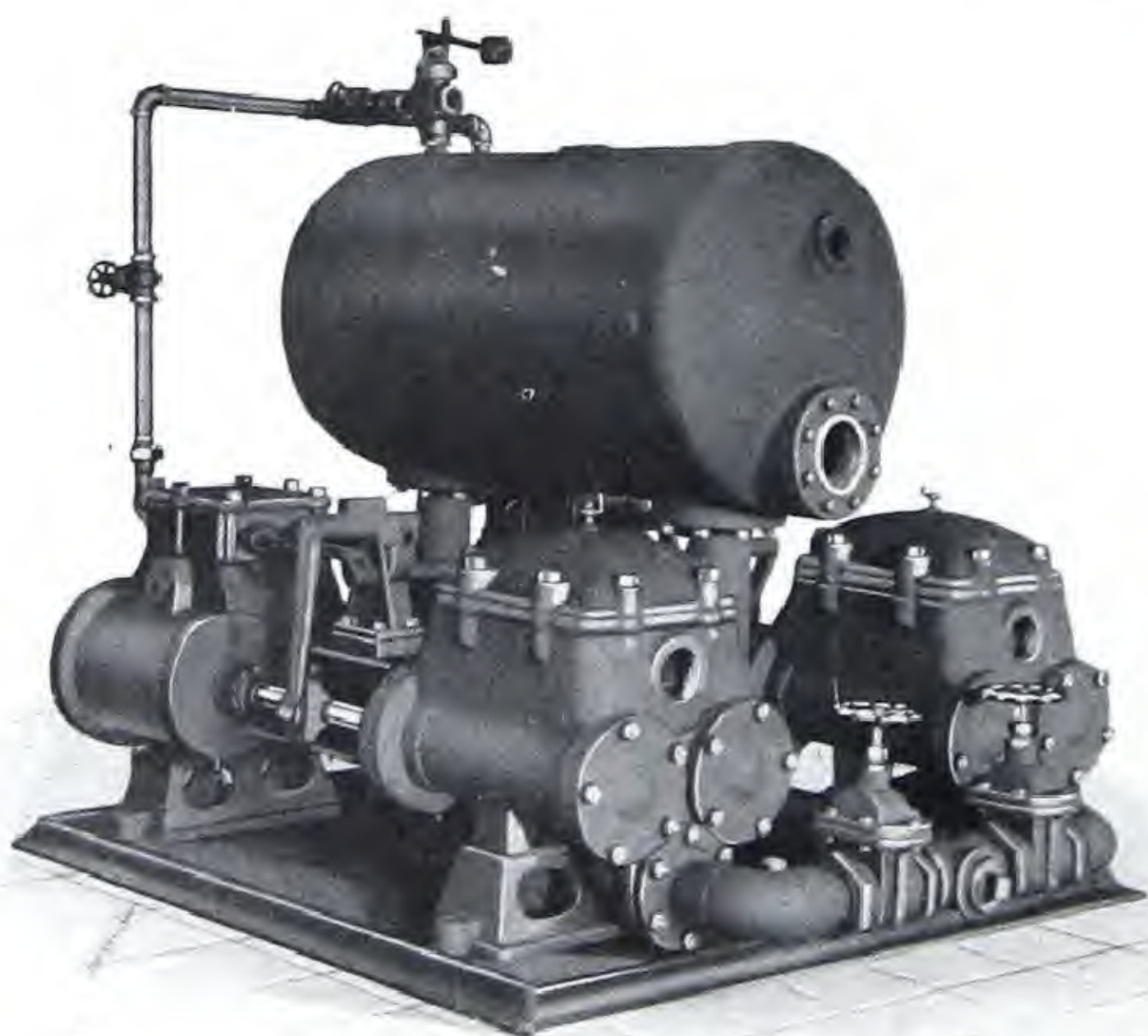
THE SMART TURNER MACHINE CO. LIMITED

HAMILTON, ONT.

Products Simplex and Duplex Automatic Feed Pumps and Receivers, steam and motor driven, for high and low pressure steam.



MOTOR-DRIVEN AUTOMATIC FEED PUMP AND RECEIVER



DOUBLE AUTOMATIC FEED PUMP AND RECEIVER

Steam and Power
Vacuum Pumps.

Motor and Belt Driven
Centrifugal Pumps.

Motor Driven Bilge and
Sump Pumps.

Simplex and Duplex
Steam Pumps for
Boiler Feeding.

Motor and Belt Driven
Triplex Power Pumps
for Boiler Feeding.

Motor Driven Centrifugal
Pumps for Boiler
Feeding.

SERVICE—We give every possible assistance in directing the style of Pump required

Send for Catalogues

THE SMART TURNER MACHINE CO. LIMITED

HAMILTON, ONT.

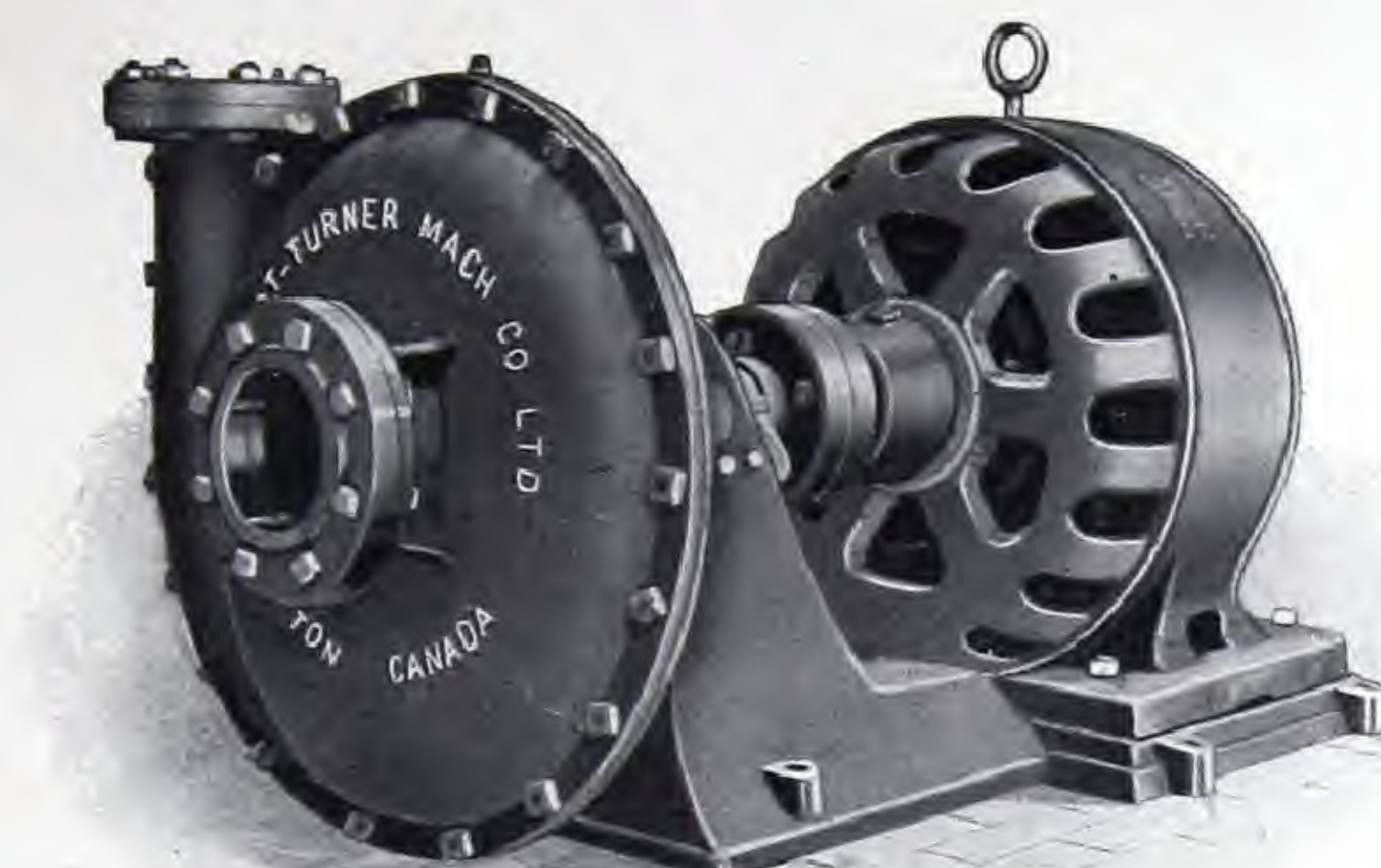


Fig. 114
Motor Driven Centrifugal Pump

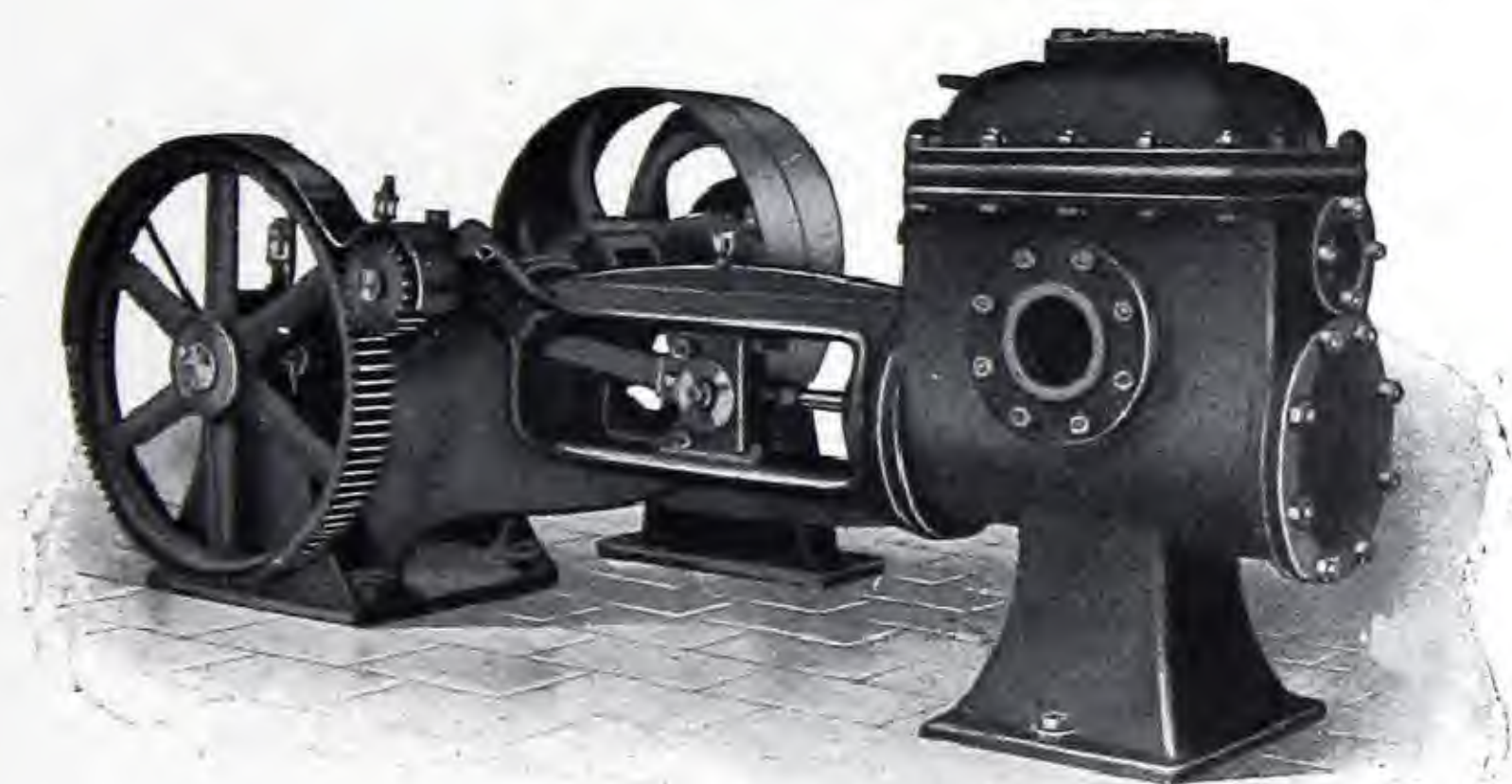


Fig. 108
Power Vacuum Pump

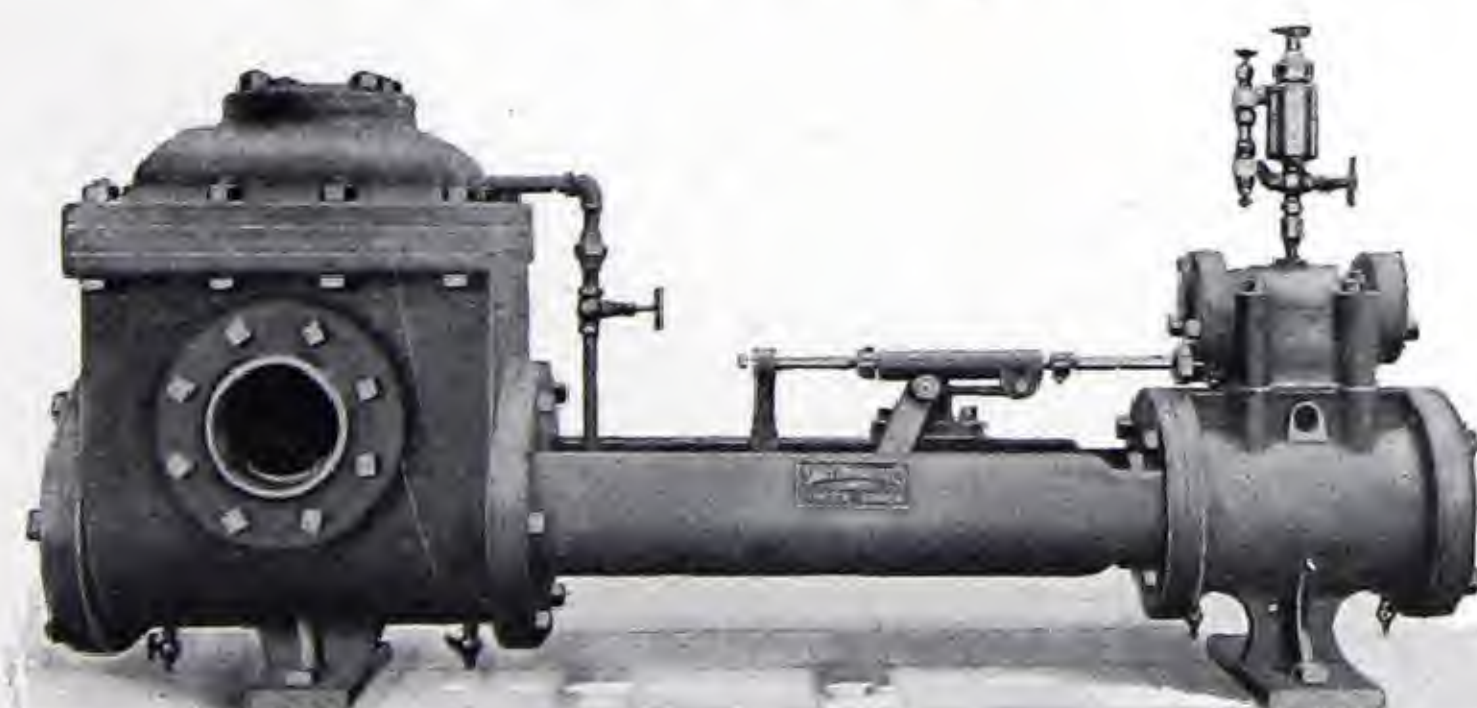
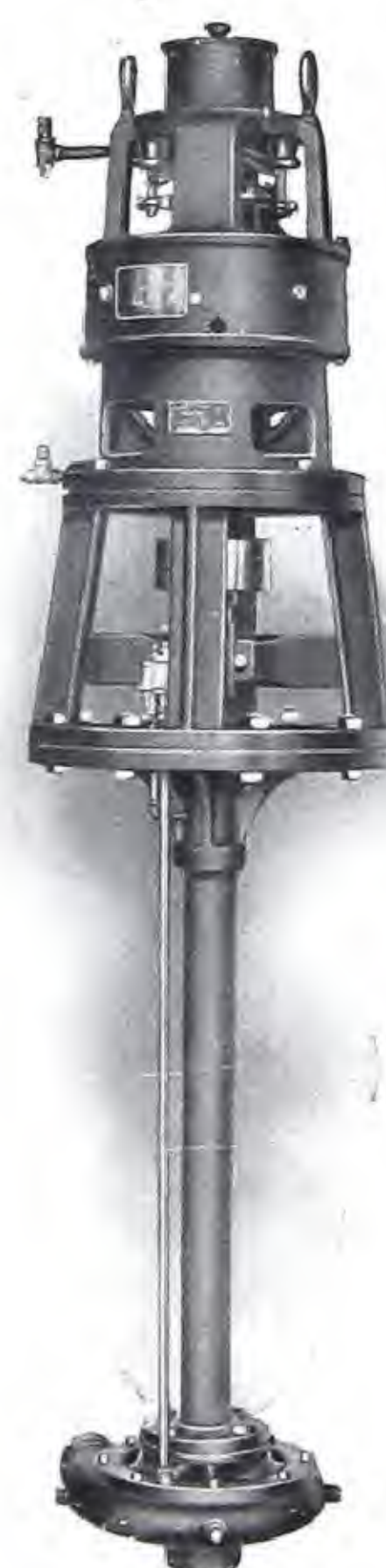


Fig. 134
Steam Vacuum Pump



W 173
Vertical Motor Driven
Centrifugal Pump

LAUNDRY MACHINERY

GENERAL.

In recent years it has become the custom to equip large residences, apartment houses, hotels and various institutions used as residences with laundries. The following is a brief description of some of the most usual machines:

WASHERS.

In all washers, the washing is effected by the rotation of a perforated inner cylinder which carries the load of clothes and effects a motion by dropping in the water and forcing the water through the fabric and into the outer cylinder. Thus a rapid circulation of water and suds is set up. The goods are washed, boiled, rinsed and blued before leaving the machine.

Most washing machines are constructed with a water-tight drum, having a door at the top for convenience in handling goods. Inside of the drum is the perforated cylinder, which is controlled by a reversing mechanism which causes the cylinder to revolve a certain number of times in one direction and then in the other. This reversing mechanism is the most vital part of the washing machine. The reverse is complete, the cylinder travelling absolutely the same distance in each direction; this exact and positive reverse motion prevents the goods from being tangled or torn.

In all type of washers the construction is such as to distribute the strain of the reverse over a large area, and thus relieve the journal boxes in particular, and the entire mechanism in general.

Great care should be taken in arranging stuffing boxes so that the lubrication will not be flushed out in operation. In wooden washers, the inside cylinders are generally made of Georgia pine, which wears smoothly, is easy on clothes and very durable. The outside case is usually of cypress. Particular emphasis is to be placed upon the care with which this stock is selected.

EXTRACTORS.

The underlying principle on which all extractors are built is the same—water is extracted and the linen is partially dried by the application of centrifugal force. In operation the goods are placed in an inner basket usually made of copper, which revolves at a high rate of speed. The linen is thus pressed against the perforated side of this basket, and the water is allowed to escape to the outer curb from which it is emptied into the drain.

Extractors should be built to withstand the strains due to eccentric loads rotating at very high speeds, and should be as nearly self-balancing as it is possible to make them.

DRYERS.

All modern laundries, even of small capacity, can be equipped to good advantage with a dryer. These consist of a cabinet or room arranged to accommodate the clothes on racks and in which the temperature can be raised by means of steam coils or a circulating current of heated air. The dryer is ventilated to remove the saturated air and thus facilitate drying. Among the advantages of "artificial" drying may be mentioned the independence of weather conditions, bleaching tendencies reduced to a minimum by the absence of sunlight while the clothes are wet, rapidity of drying, cleanliness, the clothes not being exposed to soot and dust, etc.

IRONERS.

There are numerous ironers on the market for various classes of work, such as collar and cuff machines, body ironers, bosom ironers, flat work ironers of many sizes, and so on. All these machines are similar in principle, making use of heat and rolling. The heat being applied in various ways.

Ironing by pressure only, has recently been adopted, the aim being to produce a surface perfectly smooth, without gloss, and preserving as nearly as possible the original finish of the goods when new. This requires an operation with no friction or motion—by pressure—the goods being ironed, being under pressure until thoroughly dried, thereby preventing any wear or stretching, and making it possible to shape a garment in such a manner as to give it a characteristic "new" appearance not obtainable in by other method.

LAYOUT OF LAUNDRIES.

There are many important things for architects to know in connection with specifying laundries for institutions, hotels, etc. Some of these are as follows:

Openings.—Hallways, doors or windows should be not less than 5 feet wide.

Foundation.—Washers and extractors should straddle an improved open drain cement gutter.

Ceiling.—Not less than 10 feet high.

Room.—Should be quite large and not partitioned off, but all in one room; large amount of space is required for soiled linen awaiting washing and for the laundered goods in process and assorting.

Windows.—Run from about five feet high above floor to close to ceiling for good light and ventilation.

Floor.—Cement floor is always to be recommended. Consult the laundry machinery manufacturers for layouts, drawing, and specifications.

STACKS AND CHIMNEYS

HEIGHT AND CROSS-SECTION.

Two things that, prior to all others, concern the designer of a chimney are the height and internal sectional area. These will vary with the volume of gases to be discharged and the draft desired. The problem is usually stated as follows: "For a given horse-power, what are the height and cross-sectional dimensions of the chimney that will be required?" Since the consumption of fuel will vary with the horse-power directly or nearly so, the problem may be stated in this way:—"Given the consumption of coal per hour, to find the height and cross-section of a suitable chimney."

DRAFT.

The draft of a chimney, as is well known, is due to the excess of weight of a column of external air over that of the heated column of equal height contained in the chimney. The flow of air is due to much the same causes that produce a current of water in the piping of the heater on a kitchen range. Many mathematical investigations based on thermodynamic fundamentals have been proposed, Rankine, Peclet, Wood and Pinzger being the best-known contributors. The unfortunate feature, however, has been lack of agreement among the results obtained, due, doubtless, to differences in the logical sub-structure and in the assumptions made by those who have essayed to reduce the problem to a mathematical basis. We are forced to the conclusion that the problem of chimney draft is one difficult of satisfactory treatment

in a purely theoretical way. The results obtained, however, have been modified by experiment and experience, and form the basis of empirical formulae which are employed in design. With no attempt to indicate how these results are arrived at the following "rules" are given as being typical. These are said to agree very well with modern Canadian practice.

Where F is the fuel consumption in lbs. per hour.

R is the fuel consumption in lbs. per sq. ft. of grate per hour.

G is grate area in sq. ft.

T is temperature of chimney gases in degrees Fahr.

a is grate opening area in sq. ft.

H is height of chimney in feet above the grate, and

S is the sectional area of chimney flue in sq. ft.

$$G = \frac{F}{R}$$

$$a = 0.4 G$$

$$H = 100 \frac{0.2}{T} \left(\frac{F}{a} \right)^2$$

$$S = \frac{F}{60}$$

The following table has been calculated on as assumed consumption of five lbs. of coal per H. P. per hour, a rate of consumption per sq. ft. of grate area as given in column No. 3, and a temperature of chimney gases of 500° degrees Fahr.

GALE'S CHIMNEY TABLE

H. P.	Coal per hr. lbs. F	Coal per sq. ft. of grate per hr., lbs. R	Grate area sq. ft. G	Grate opening area, sq. ft. a	Height. ft. H	Chimney cross section area sq. ft. S
20	100	13	7.7	3	44	1.6
60	300	15	20	8	56	5.0
100	500	17	30	12	70	8.3
200	1,000	19	53	21	90	16.6
400	2,000	21	95	38	111	33.3
600	3,000	23	130	52	133	50.0
1000	5,000	25	200	80	156	83.3

1. The weight of pure air at 32 degrees F. and at the ordinary barometric pressure, 29.92 inches of mercury, is .080728 lb. per cubic foot, the volume of one pound being 12.387 cubic feet. Air expands 1-491.2 less .002036 of its volume at 32 degrees F. for every increase in temperature of 1 degree F. Tables have been prepared from which we can take the weight of a cubic foot of air at any temperature and from which we can calculate the difference in weight between the column of external air and of the chimney gases. For example, the difference between

the weight of a column of gases having a temperature of 500 degrees in a stack having a sectional area of 36 sq. ft. and a height of 100 feet, and the weight of a column of the same cross-section and height of outside air at a temperature of 52 degrees is 124.85 lbs. If the stack were twice as high, the other conditions being the same, the difference in weight of the columns of air and stack gases would be twice as much, and hence the pressure or draft twice as great. Practically, however, there is a limit to both factors governing the draft, beyond which no increase

of draft is secured. In the first place, the temperature of the gases in the stack decreases toward the top quite rapidly, until after a height of 175 to 200 feet, the temperature of the gases is so low at the top of the stack that practically no increase of draft is secured by making the stack higher. Moreover, there is a temperature of the gases in the stack, 622 degrees F., at which the maximum quantity of air passes up the stack and beyond which the density of the gases decreases more rapidly than their velocity increases.

FOUNDATIONS.

In the design of the foundation of a chimney, as of that of any other structure, the aim will be to prevent settlement, and especially unequal settlement. On foundations much has been written, and it would seem as though little remains unsaid. The character of the foundation and its size will depend on the character of the soil upon which the chimney is to be erected. The following safe loads in tons per sq. ft. for various materials represent what experience has shown to be good practice:—

Quicksand, $\frac{1}{2}$ ton.
 Sand, 4 tons.
 Clay, 4 tons.
 Gravel, 8 tons.
 Solid rock, 200 tons.

The bounding planes of the sides of the foundation should be inclined outward, extending the bearing area so that the maximum allowable stress may not be exceeded. In case of soft soil, piling may be necessary. The piles will carry, as is usual, a grillage, or their heads will be imbedded in concrete.

It is often advisable to have a lining to a concrete or brick chimney. This lining usually takes the form of an independent shaft concentric with the outer shell, and should be separate from the latter to permit of independent contraction and expansion. The material of which it is constructed should be sufficiently refractory to resist the high temperature of the chimney gases. It may or may not extend to the top as is thought advisable. Its thickness is usually much less than that of the chimney proper.

STABILITY.

There are two items which enter into the discussion of chimney stability. The first is the weight of the chimney, and the second is the action of wind. The line of action of the weight of material above any horizontal cross-section in a chimney symmetrically built of homogeneous materials, will be through the centre of gravity of that section. The effect of the wind action about any such section is to create a moment. Now a couple and a single force are the equivalent of this same single force at a new point of application. In other words, the effect of the wind is to shift leeward the point of application of the force which represents the weight. In short, we have a case of eccentric loading at the cross-section, the amount of the eccentricity depending of course on the magnitude of the couple created by the wind. A reference will be all that is necessary

to recall to the reader's mind that a uniformly varied stress is the necessary concomitant of eccentric loading, and hence the usual equations applying thereto may be used in this instance. In certain cases, brick chimneys, for example, it is important that the eccentricity be not greater than would produce a zero stress at the windward side. This is tantamount to saying that the maximum stress (i.e., on the leeward side) will be double of that at the centre of gravity of the cross-section.

Where x_0 is the eccentricity of the load, i.e., its distance from the C. G.

p is the average stress at the section, i.e., the stress at the C. G.,

$p_{\max.}$ is the greatest stress at the section, x is half the outside diameter of the shaft, and

k is the radius of gyration of the cross-section,

$$\frac{p}{p_{\max.}} = \frac{1}{1 + \frac{x_0 x_1}{k^2}}$$

In order that p may be half of $p_{\max.}$ and therefore that $p_{\min.}$ may be zero,

$$\frac{1}{1 + \frac{x_0 x_1}{k^2}} = \frac{1}{2}$$

$$\text{From this } x_0 x_1 = k^2$$

$$\text{and } x_0 = \frac{k^2}{x_1}$$

Consider the case of a hollow circular chimney whose outer and inner diameters are respectively $2x_1$ and $2x_2$.

Remembering that $I = k^2 A$ where I and A are respectively the moment of inertia and area of the cross-section, we obtain

$$\begin{aligned} x_0 &= \frac{k}{x_1} = \frac{I}{x_1 A} = \frac{\frac{\pi}{64} \{ (2x_1)^4 - (2x_2)^4 \}}{x_1 \frac{\pi}{4} \{ (2x_1)^2 - (2x_2)^2 \}} \\ &= \frac{(2x_1)^2 + (2x_2)^2}{16x_1} = \frac{x_1}{4} + \frac{x_2^2}{4x_1} \\ &= \frac{2x_1}{4} \text{ where } x_2 = x_1. \end{aligned}$$

This may be interpreted as meaning that the limiting position of the point of application of an eccentric load on a horizontal section of a cylindrical chimney with thin walls, in order that no tension may result in any part of the cross-section, is distant from the centre of gravity of the area, $\frac{1}{4}$ of the diameter. The point of application of the load is sometimes called the centre of resistance. Similarly, it may be shown that for a square chimney with external and internal diameters of $2x_1$ and $2x_2$ respectively, x_0 approaches the limit $\frac{2x_1}{3}$ as the thickness of shell becomes less and less.

Rankine defines the moment of stability of a structure as follows:—"The moment of stability of a body or structure supported at a given plane joint is the moment of the couple for forces which must be applied in a given vertical plane to that body or structure in addition to its own weight, in order to transfer the centre of resistance of the joint to the limiting position consistent with stability." It is manifest from the above that Rankine intended his definition to apply especially to structures the material of which is incapable of resisting tension. To other structures, notwithstanding, the term may be applied; and that in such cases it is an extremely useful quantity, we shall subsequently endeavor to show. From what has been said, it is at once apparent that where W is the weight of the structure and x_0 the horizontal distance from the centre of gravity of the cross-section to the limiting position of the centre of resistance, Wx_0 will be the moment of stability.

WIND VELOCITY.

The relation between wind velocity and wind pressure has a practical as well as a scientific interest; yet since in design, it is for maximum stresses that we must provide, and frequently against abnormal conditions that we must safeguard, there is but one velocity—and that is the greatest—in which we are really concerned. Smeaton gives the following rule for determining the pressure due to wind:—

Where p is the pressure in lbs. per sq. ft. and

v is the velocity in miles per hour,

$$p = \frac{v^2}{200}$$

On this assumption, the following table has been constructed:—

SMEATON'S WIND TABLE.

v Miles per hour	p Pds. per sq. ft.
2	.02
4	.08
12	.75
25	3.00
30	4.50
35	6.00
40	8.00
45	10.00
50	12.50
60	18.00
75	28.20
80	32.00
90	40.50
100	50.00

It will be generally admitted that the effectiveness of wind will be reduced if the surface upon which it acts be curved or oblique to the direction of the wind. Wilson gives the following:—

- Pressure on a square tower assumed = 1.
- Pressure on a hexagonal tower = $\frac{3}{4}$.
- Pressure on an octagonal tower = $\frac{65}{100}$.
- Pressure on a circular tower = $\frac{1}{2}$.

Taking the maximum wind pressure on a plane surface as 50 lbs. per sq. ft., that on the projection of a cylindrical tower would be but half that amount.

Suppose that a chimney is acted upon by the wind, the net effect of which is a force P acting at a point h above some horizontal section under consideration. It is apparent that the moment due to wind action is Ph . Now if Ph be less than Wx_0 the entire cross-section will be in compression since the centre of resistance will not be thrown to its limiting position. If Ph be equal to Wx_0 then the line of zero stress at the section will be at the windward side, and the compressive stress on the leeward side will be exactly double of the stress at the centre of gravity, or to speak more correctly, will be double of the stress along a line in the section passing through the centre of gravity transverse to the direction of the wind. If, on the contrary, Ph be greater than Wx_0 , the effect will depend on the character of the material of which the tower is built. If of material incapable of resisting tension, the effect will be to reduce the effective area of the cross-section in resisting stress. If the material be capable of resisting tension, the effective area subjected to stress will not be reduced, the stress at the centre of gravity will remain constant and the neutral line will lie within the area. To the latter class of structures belong steel and reinforced concrete.

REINFORCED CONCRETE CHIMNEYS.

The factory chimney constructed of reinforced concrete is designed to resist tension as well as compression. The excess of the wind moment over the "moment of stability" so-called, is the quantity producing on the windward side a tension which is assumed to be wholly resisted by the steel embedded in the concrete. As an instance of this design take the following case:—

As may be seen from the figure, the chimney stands 100 ft. above ground and has a constant outer diameter of 11 ft. 4 in. It consists of an inner and an outer shell, the former being practically independent of the latter. The outer shell has a thickness of seven inches for the first 30 ft. of its height, a thickness of six inches for the next 30 ft., and for the last 40 ft. the outer radius is but 5 inches longer than the inner. The vertical reinforcing of this shell will be considered, and that at section $E F$ only. The following assumptions will be made:—

1. That concrete weighs 140 lbs. per cu. ft.
2. That the maximum pressure due to wind is 50 lbs. per sq. ft. on a plane surface.
3. That wind pressure may be considered as acting at a point half the height of the tower above ground where the width is constant.
4. That the entire tension in the chimney due to wind is borne by the steel, for which a maximum allowable tensile stress will be taken as 12,000 lbs. per sq. in.

To compute the weight of the outer shell:—
 Outer dia. = 11 ft. 4 in. = 136 inches.
 Inner dia. = 10 ft. 2 in. = 122 inches.
 Area of outer circle = 14,526 sq. in.
 Area of inner circle = 11,689 sq. in.
 Diff. (area of annulus) = 2,837 sq. in.
 Wt. of sec. 30 ft. high = $2837 \times 30 \times 140$

144 82,746 lbs.

Similarly, weight of second section 30 ft. high = 71,458 lbs.
 And weight of third section, 40 ft. high = 79,994 lbs.

Total weight = 234,198 lbs.

Wind pressure = $\frac{1}{2} (11 \frac{1}{3} \times 100) 50 = 28,333$ lbs.

Height of point of application of wind above ground = 50 ft. = 600 inches.

To obtain the value of the moment of inertia of the cross-section.

$$I = \frac{\pi}{64} \left\{ (2x_1)^4 - (2x_2)^4 \right\}$$

$$= \frac{\pi}{64} \left\{ 136^4 - 122^4 \right\} = 5,907,859.$$

To find the value of the square of the radius of gyration of the cross-section:—

$$k^2 = \frac{I}{A} = \frac{\frac{\pi}{64} \left\{ (2x_1)^4 - (2x_2)^4 \right\}}{\frac{\pi}{4} \left\{ (2x_1)^2 - (2x_2)^2 \right\}} = \frac{(2x_1)^2 + (2x_2)^2}{16}$$

$$= \frac{136^2 + 122^2}{16} = 2086.$$

To find the maximum value of x_0 (the eccentricity) in order that no tension may result in the cross-section:—

$$x_0 = \frac{k^2}{x_1} = \frac{2086}{68} = 30.6 \text{ in.} = \text{say } 31 \text{ in.}$$

Moment of stability = $Wx_0 = 234,198 \times 31 = 7,260,138$.

Moment of wind = $28,333 \times 600 = 16,999,800$.

Excess of moment of wind over moment of stability = $16,999,800 - 7,260,138 = 9,739,662$.

This may be designated the bending moment. Employing the well-known beam formula,

$$\frac{p}{y} = \frac{M}{I} \text{ and noting that for the case in hand,}$$

$$y = 68 \text{ ins.}$$

$$M = 9,739,622, \text{ and}$$

$$I = 5,907,859,$$

we find the value of p to be $\frac{9,739,662 \times 68}{5,907,859}$
 = 112 lbs. per sq. in.

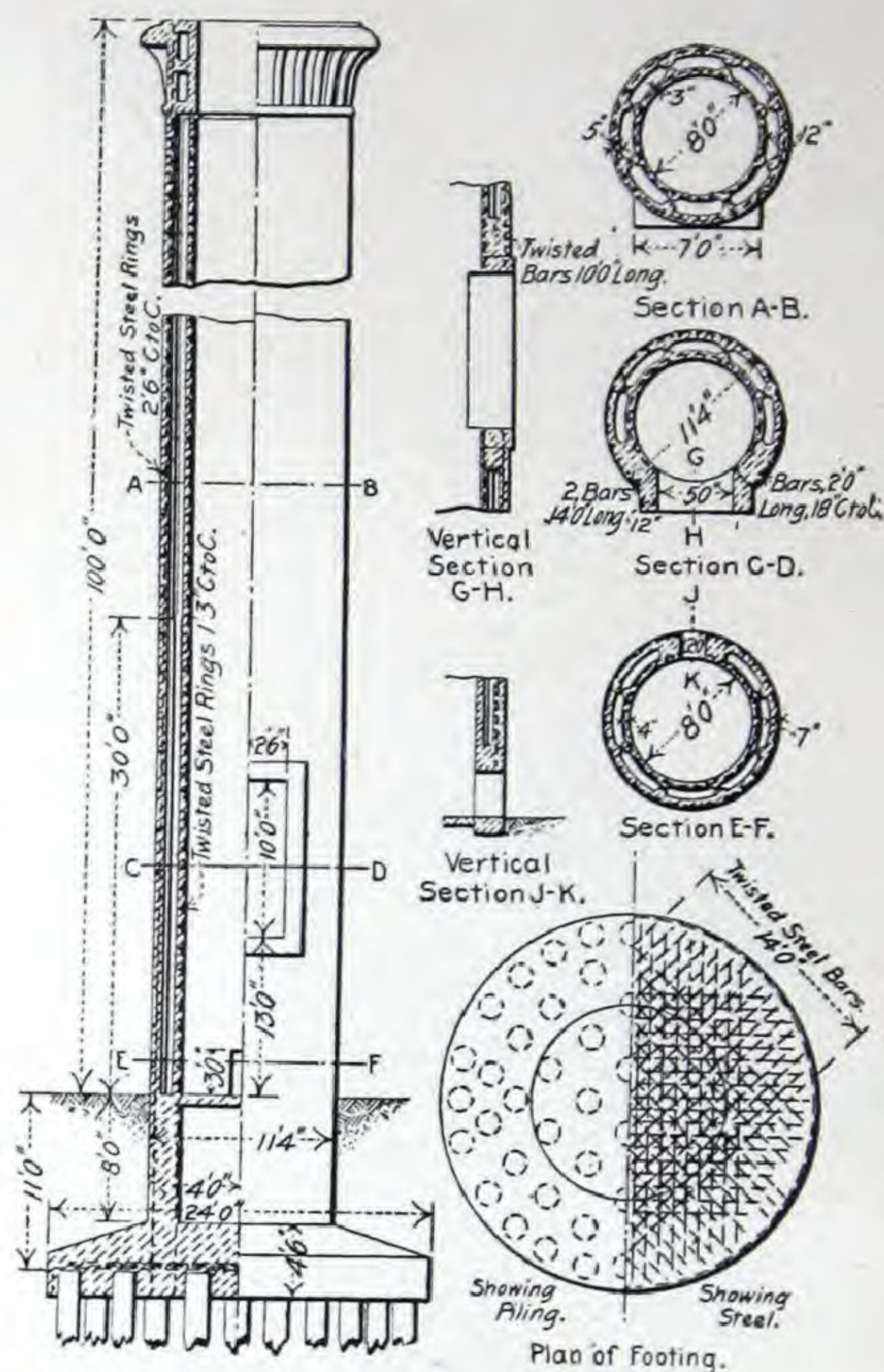
Remembering that as the wind may approach from any side, the total tension to be provided against will be approximately

$$p A = 112 \times 2,837 = 317,744 \text{ lbs.}$$

At 12,000 lbs. per sq. in., this would necessitate the employment of $317,744 \div 12,000 = 26.5$ sq. ins. of metal.

If $\frac{3}{4}$ in. sq. rods are used, the number of vertical pieces becomes $\frac{\frac{3}{4} \times \frac{3}{4}}{26.5} = 48$ rods nearly.

Similarly, computations may be made for sections C-D and A-B.



SPECIFICATIONS FOR RADIAL BRICK.

Proposals will be received on radial brick chimney according to manufacturers' standards, which must comply in general dimensions with chimney as shown by plans.

The radial brick chimney shall conform in all respects to the building laws applicable to this work, and detailed plans shall be furnished for the approval of the architect.

The radial brick shall in general consist of well burned dense perforated brick, those having corrugated sides preferred. The brick shall have an absorption of not more than ten per cent. of water when immersed for a period of twenty-four hours, and shall be capable of standing a compression test of not less than five thousand pounds per square inch.

The bond in the brick shall show interlocking not more than three courses in height, and the top shall be finished off in a neat approved manner.

The exterior of the column shall be one straight and true taper, and perfectly plumb to the centre. The face brick to match as evenly as possible.

